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One Year's Growth

Our first anniversary which fell on January 12th furnished a good time for looking backward on the progress made thus far and ahead on our hopes and plans for the years to come. It is hoped that each member, Senior, Junior or Student will join with me in a personal appraisal of what A.I.I.E. has meant to him and what he has meant to the organization.

We have grown from the little group of twelve that voted to start a society and to invite others of like interest to join with them until we now have approximately 500 Junior and Senior members and about 750 members in student chapters. We have received favorable attention from many Industrial Engineering faculties, who because of lack of accreditation or other local reasons have had to postpone the formation of student chapters. We have received the endorsement of Mr. Alexander Van Praag, President of the National Society of Professional Engineers. Local chapters have been formed. Many other points of advancement could be cited, but most of our members already know of these through the News Letter which has been published a number of times during the past year.

Looking forward, the most encouraging thing is that we have a definite program and that new members are coming in every day. This program includes, launching of the Journal of Industrial Engineering to provide the same unifying force for our branch of the profession as has been so long enjoyed by the "founder societies" and other professional technical groups through their respective publications. We plan to continue the formation of local chapters in all localities where there are enough members to warrant programs of meetings and local interchange of ideas. We plan to continue contacts with all colleges and universities offering approved instruction in Industrial Engineering until a majority of the leading institutions are represented in our body. We plan to step up the tempo of our publicity work to the end that the entire industrial public shall know more of the work of the Industrial Engineer, and shall learn to recognize him as a true professional man, rather than confuse him with mere technicians or ordinary business operators. We also plan to conduct research in the field of Professional Registration of Industrial Engineers by the 48 states, and concerning the types of positions held by members of our profession. There are of course a number of other points in our forward planning such as that of contacting every eligible Industrial Engineer that can be located to invite him to join with us, but these points will serve to illustrate the program.

Notwithstanding the progress made, it is easy to understand that some members, especially those in remote locations whose only contact so far is through infrequent letters or publications, may well ask the question, "What has A.I.I.E. amounted to, has it been worthwhile for me to join, what do I get out of it?" But I would like to be so bold as to ask you to turn the question around and ask instead, "What have I done for A.I.I.E.? What has the organization and the other member groups gotten from me? Have I obtained any new members, contributed to the formation of a chapter, submitted any material for publication, written in suggestions about ways in which the objectives of our society can be attained, or ways that the objectives should be re-oriented?"

I sincerely hope that all members will continue to view the work of our Institute as an opportunity for mutual service. I feel sure that most of you joined in full realization of the fact that we are not yet big, we do not speak with a powerful voice in the affairs of the great engineering fraternity, but we have the opportunity of doing so one day. Whether or not we will do so depends upon each individual member.

In making the foregoing remarks and suggesting the questions, I have a strong realization of the fact that there are many members who have worked diligently and given freely of themselves to promote our joint aims, and I ask all others to join with me in honoring them and thanking them for their several contributions. Finally I pledge myself to try to contribute more in the coming year and hope that you will join me in this pledge.

Dwight D. Gardner

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The Cover -

Checking a three-dimensional layout against the blueprints from which it was made.

Courtesy - Ford Motor Company

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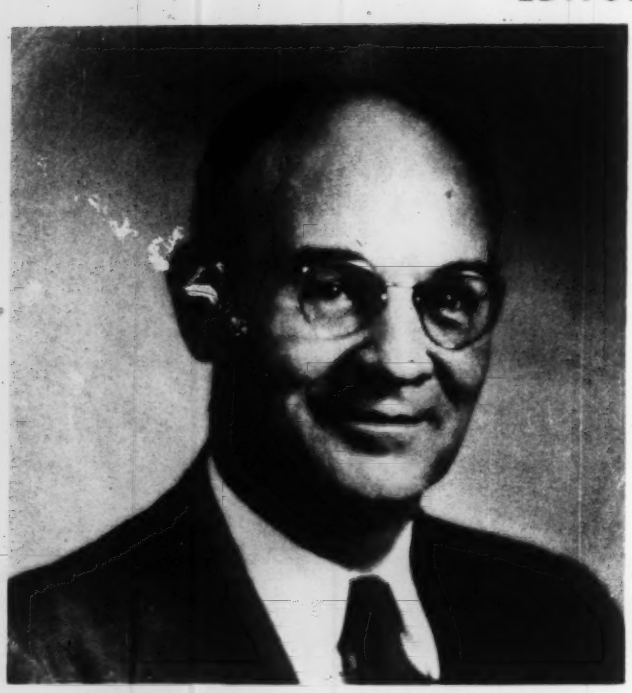
EDITOR'S PAGE



The Industrial Engineer's Needs

In a matter of but a few years Industrial Engineering has come of age. Until a decade or so ago, technology was the thing. Human problems of production drew second billing. Now, however, the situation is considerably different. Recent developments have caused management and labor to turn to the man with the scientific management tools, the Industrial Engineer.

We have grown up too fast for our own good. We are a big body now, shoulder-to-shoulder with well-established branches of engineering. But we are seriously deficient in those strength-preserving qualities which make for endurance. Our needs are great.

The Industrial Engineer needs a more dynamic and enlarged fraternity. He needs the companionship of men who speak his language.

The Industrial Engineer needs a means of broadening his technical knowledge beyond the confines of his own plant or locality. He needs a medium of communication with which he can exchange ideas and experiences with other Industrial Engineers all over the world.

The Industrial Engineer needs the cooperation of other Industrial Engineers in the matter of public relations. The outstanding accomplishments and potentialities of his profession must be made known to all.

To summarize, the Industrial Engineer needs AIIE because it was founded for the sole purpose of fulfilling these needs. Through AIIE the Industrial Engineering profession can fortify the strength and integrity so necessary for professional recognition in the engineering world.

F. F. Groseclose, Editor-in-Chief

Total Membership Breakdown for AIIE as of May 1, 1949

Student Membership by School

Alabama	- 78
Columbia	-107
Georgia Tech	-136
Northeastern	- 18
Ohio State	-204
Oklahoma A & M	- 77
Pittsburgh	- 66
Syracuse	-127
Texas Tech	- 64
Washington	- 61
TOTAL STUDENTS	938

Active Members by Grade

Junior	- 150
Senior	- 191
TOTAL ACTIVES	341

Grand Total Membership 1,379

FINANCIAL REPORT
American Institute of Industrial Engineers'
January 12, 1948 - January 12, 1949

RECEIPTS

Initiation Fees	$341.00	
Junior Dues	105.00	
Senior Dues	600.50	
Student Dues	424.50	
A.I.I.E. Pins	213.00	
		$1.684.00

DISBURSEMENTS

Clerk Hire	$129.51	
Printing	141.58	
Supplies	49.91	
Postage	76.07	
Equipment	133.38	
Chapter Aid	17.85	
Dues to Others	25.00	
Misc. (Band Chgs. Etc.)	10.20	
A.I.I.E. Pins	240.04	
		$ 823.54
Balance in Bank		$ 860.46

J. W. BOSLEY, Jr.
Treasurer, A.I.I.E.

Professor Johnson to Coordinate Student Chapters

Professor C. K. Johnson, head of Industrial Engineering at the University of Alabama, has been appointed Student Chapter Coordinator for the Institute. Professor Johnson replaces Mr. S. Steiner who resigned when leaving the teaching field to take the position of Methods Superintendent at the Oliver Manufacturing Company.

Professor Johnson is also Faculty Advisor of the Alabama Student Chapter of AIIE which consists of sixty members. He will take over the work of corresponding with other colleges and universities regarding the formation of Student Chapters. He will also work with officers and advisors of existing Student Chapters with respect to their problems.

Student Chapters of the American Institute of Industrial Engineers are limited to those colleges and universities having curricula in Industrial Engineering accredited by the Engineers' Council for Professional Development, or about to receive such accredation. Active chapters are operating at the University of Alabama, Columbia University, Ohio State University, Oklahoma A. & M. College, The University of Pittsburgh, and Texas Tech. Others are in the process of formation at Washington University, Georgia Tech, Syracuse University, and Northeastern University.

Requirements for membership in the Institute are high. Senior and Junior members must be either Registered Professional Engineers, or be graduates of accredited curricula in Industrial Engineering. The objectives of the Institute are to raise the professional standards of Industrial Engineering, to render assistance to colleges and universities engaged in teaching the subject, and to serve as a clearing house of information for State Boards of Registration in connection with their problems of Industrial Engineering.,

STUDENT CHAPTERS

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AIIE-Student Chapter
(Provisional, pending accrediting)
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Lubbock, Texas

WASHINGTON UNIVERSITY
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5830 Westminster Place
St. Louis 12, Mo.

WILLIAM H. SNYDER

W. H Snyder is a native of Baltimore. He was educated in the public school there and studied at Johns Hopkins University.

In 1938 he joined the staff of the Glenn L. Martin Aircraft Company During the war, he was assigned to the plant of a major sub-contractor.

When the Production Control Room was organized, after the pattern developed by Mr. G. T. Wiley, vice-president in charge of manufacture at the Martin Company's Nebraska Division, Mr. Snyder assisted in its development and has supervised the activities since.

During the war he was chosen to supervise the wartime indoctrination program and, in this capacity gave informal weekly talks on company activities.

Senior Chapter Activities

Two chapters have been organized so far. Columbus Chapter started about the same time that the Institute was organized. For a time, the small group of members in the Columbus area met at the University to transact the business of organizing the National group. When the National Constitution was completed and arrangements made for a mail vote to permit all members to participate in the adoption of the constitution and by-laws and the election of officers, they voted to adjourn as an organizing committee of the whole and to reconvene as the Columbus Chapter. Regular monthly meetings have been held since, principally as dinner gatherings. A number of very fine speakers have been obtained by the Program Chairman, Mr. Stephen D. Veirs, and the membership has grown steadily.

The Dayton Chapter was started somewhat later, last October, and the first meetings were held at the home of Mr. James Kohr, President. Growth in interest and attendance has also been steady here and on Monday April 25th a dinner meeting was held with 28 members and guests in attendance.

THE MARTIN SYSTEM OF PRODUCTION CONTROL

BY W. H. SNYDER
Production Control Room
The Glenn L. Martin Company

Since the establishment of the Production Control Room at The Glenn L. Martin plant, management and supervision find that they spend less time reading and analyzing voluminous reports on production activities, yet have less difficulty than ever before in determining where and when preventative or corrective action is necessary. Employees are more aware of the part they play in the business of the Company--and as a result find more interest in their jobs. Customers are shown what happens behind the scenes when they place an order.

The Control Room achieves its objective by the centralization of more than 200 graphs and charts which show the status of all production activities -- from the release of engineering drawings to the delivery of the finished product. The charts are taped to hinged boards for greater accessibility and are posted every day, without being removed from the boards. The room is open to all personnel. Customers' representatives are given full access to it. Problems are thus brought out into the open, where the most widespread efforts can be applied to their solution.

Those who maintain the Control Room enter information on the charts from reports supplied to them, prepare new charts when needed, and familiarize visitors with the information available on the charts. The departments responsible for actual production operations are required to supply the daily reports from which the data are posted.

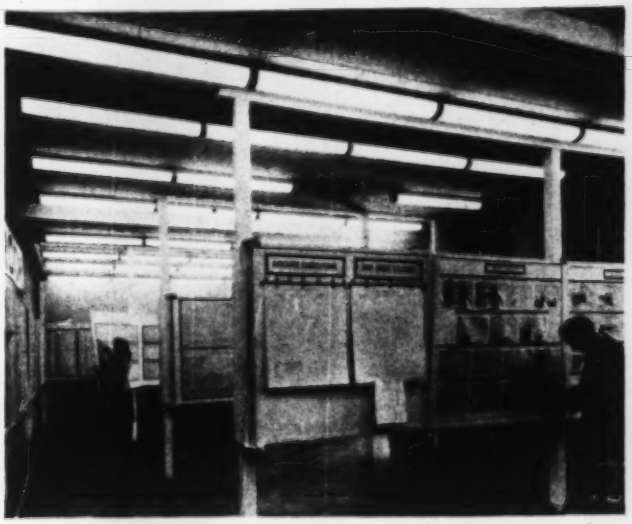
Only two people are needed to maintain the charts and graphs. Preparation of the daily reports for posting requires very little additional time or expense in the contributing departments, because the information accumulated is largely of a nature which they must have on hand for their own activities. In most cases, therefore, the reports to the control room involves merely the transcription of standing information.

Three types of charts are used -- line graphs, bar and pictorial charts. They are as simple in design as possible. They contain information of two kinds: scheduled or planned performance, and actual performance. The former are posted from master production and engineering release schedules. The actual performance lines are posted from the daily reports from the various departments. The method of charting progress follows the same pattern

on all contracts, except that production schedules which involve large numbers of ships are charted in greater detail than are experimental projects or others calling for small quantities.

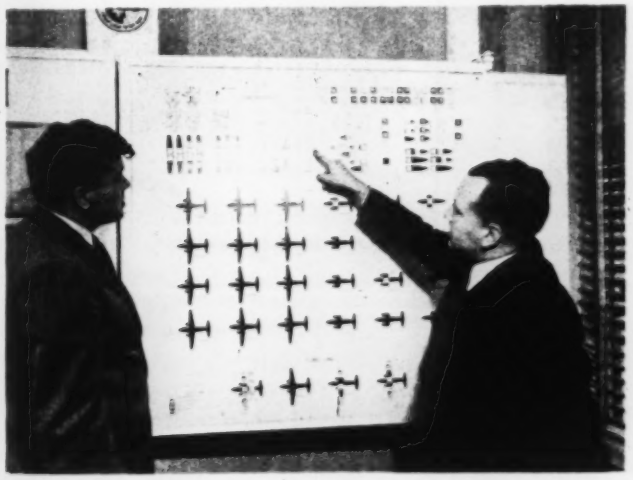
A line graph showing the release of engineering drawings to the manufacturing division is generally the first chart prepared for each aircraft contract. Release of airframe weight is the medium used to express progress. The planned release of the weight is compiled from the engineering release schedule and is plotted on the chart in blue pencil. When drawings are actually released to the production section they are accompanied by a transmittal or "job sheet", which shows how much airframe weight the drawings represent. A copy of each job sheet is sent to the control room, where the released weights are accumulated and posted daily to the graph in red pencil.

Two other lines are posted to this graph. A green line shows the planned or scheduled expenditure of engineering drafting man-hours. This line is based on the engineering release schedule. The actual expenditure of man-hours is posted in purple, and is taken from reports accumulated by the engineering department timekeeping group and sent to the control room.



To control the sequence of release, for manufacturing purposes, approximately 50 smaller graphs are maintained, representing a breakdown of the over-all release graph. Each of these covers a major assembly or system in the airplane, called a "control point." Typical control points are fuselage frames, outer wing spars, fuel system and stabilizers. The scheduled release dates for the control points vary in accordance with the sequence in which the sections must be fabricated for final assembly or installation, and the scheduled dates must be met on each control point as well as on the contract as a whole. The scheduled release lines are plotted in blue and the actual release lines are in red. On these graphs, progress is expressed in percentages instead of airframe weight.

Another graph is used to show engineering department efficiency and performance. It is maintained in conjunction with, and is based on, the over-all weight release and man-hours expenditure graph. Here are plotted the number of engineering drafting man-hours expended per pound of airframe weight released. Scheduled and actual performance are shown respectively in blue and red. The engineering department checks its progress from this graph. From the weight release graphs the manufacturing division determines both the nature and the volume of the engineering releases it will receive -- and when it will receive them.



Bar charts are used to control the availability of purchased materials, of fabricated parts and of completed assemblies. Control point numbers and descriptions are listed at the left, and ship numbers are shown across the top of each chart. Strips of blue and red cellulose tape, each covered with white tape, are attached across the chart -- one blue and one red tape for each control point -- before the chart is mounted on the display board. Performance is shown by progressively peeling off the white tape and exposing the blue scheduled performance tape and the red actual performance tape. Postings can be erased if necessary, by re-applying white tape over the colors. Red tapes which are shorter than their corresponding blue tapes reveal at a glance any control points which are behind schedule.

Control of the work load in the detail parts manufacturing department is simplified by use of a line graph in the control room. The master production plan includes a schedule which specifies how many orders for parts fabrication must be sent into the manufacturing department every day, how many orders must be completed by that department, and how many orders must be available for fabrication -- in order to meet assembly schedules.

These planned activities are plotted on the graph in broken lines; a blue line for orders issued, a red line for orders fabricated, and a green line for orders available for fabrication.

Cont'd on Pg. 14

COOPERATION BETWEEN TECHNICAL AND PROFESSIONAL SOCIETIES

by W. G. Stanton, Assoc. Prof., Dept. Ind. Engr. Ohio State University

(A brief of a speech presented before the Board of Trustees of the Ohio Society of Professional Engineers Annual Convention Meeting, March 17, 1949, Columbus, Ohio.)

Although the American Institute of Industrial Engineers has described itself in its literature as a professional technical society I propose for the purposes of this talk tonight, to define a distinction between professional and technical societies in keeping with the topic of cooperation between the two groups. Therefore I refer to professional societies as organizations devoted to the interests of the entire profession of engineering, organized to speak on behalf of engineers regardless of the branch of the profession in which they practice. Technical societies we will define as groups organized for the purpose of representing a particular branch of the engineering profession such as the electrical, mechanical or industrial engineers, in promoting better professional practices on the part of their members, better public understanding of the work of the branch, and above all to stimulate the members to realize that they are not merely electrical, mechanical or industrial engineers but are preferably professional engineers, sharing in the fortunes and troubles of the entire profession.

Since the engineering profession already suffers from a multiplicity of organizations as was so ably demonstrated by William F. Lamb, President of the Massachusetts Society of Professional Engineers in his article in the April 1946 issue of the American Engineer. One might immediately ask why anyone should think of starting a new organization such as the American Institute of Industrial Engineers. But by answering this question specifically as to the reasons that motivated our group, I will be able to show why both the professional and the technical society needed and fell thereon my theme of cooperation between the two. Industrial Engineering is first one of the newest and least known of the branches of Engineering and consequently is most misunderstood by all segments of the public. Secondly, it is plagued, perhaps more than any other branch, by the presence on the fringes of the profession, of individuals who are only partly trained but represent themselves as Engineers. Thirdly, Industrial Engineering as a branch of the profession needs a definition of the scope limitations and objectives and no one realizes this more clearly than the members of the branch itself. Fourth, because Industrial Engineers perhaps more than the members of the other branches are generally employees, there is great need for a cohesive force to develop and preserve the unity of the branch. Fifth, for the reasons stated with respect to four, there is great need for the professional development of Industrial Engineers.

Briefly the objectives of the American Institute of Industrial Engineering are as follows:

1. To conduct a campaign of self-examination on the part of the members of the branch to the end that we may be assured that the body of professional knowledge of which we are the custodians, is in fact a distinguishable body of engineering knowledge that sets it apart from the activities of the other branches and that it is constantly developed and improved.

★ ★ ★

We set out with the goal of patterning our operations to a large extent after the founder societies and with the hope of ultimately developing for our membership the same benefits that the founder societies have rendered to the members of their respective branches but we found already in existence and functioning handsomely, the National Society of Professional Engineers. It therefore seemed foolish for us to undertake to do any of the things which have been enumerated as being the field of the Professional Societies. In the matter of legislation alone it is evident that the protection of engineers from being forced into labor unions by the repeal of the Taft-Hartley act is one for a group such as the NSPE representing all branches of engineering. Likewise the problem of inducing all of the states of the union to pass suitable legislation providing for the registration of professional engineers is not the concern of any one branch because it is entirely reasonable that all professional engineers regardless of branch should go through the same

stages of engineering training, examination, and practical experience before attaining the full status of professional engineering.

On the other hand, if the laws of a particular state or the regulations of a particular board of registration fail to recognize the existence of such a branch as Industrial Engineering we feel that we cannot the National Society of Professional Engineers to take the initiative in attempting to have this situation corrected. Moreover, if the particular state board of registration includes in the examination given to the Industrial Engineering candidates for registration, problems dealing with the very advanced thermodynamics, or asks them to design the concrete dam, to extend between described promlitories and on the other hand, fails to include questions dealing with the principles of job evaluation, establishment of wage incentive plans, or the choice of machinery for described manufacturing operations, it is our responsibility to call attention to these discrepancies and to enlist the aid of the NSPE in having corrected if we are unable to persuade the individuals involved by our own arguments.

Likewise we feel that the National Society has a sufficient job to do in developing publicity to bring about public appreciation of the profession of engineering as a total profession and that the problem of conducting the campaigns to bring about an appreciation of the fact that industrial engineering is really a separate branch of the profession of engineering and an understanding of what industrial engineers do and how they are trained is peculiarly our own problem.

One of the items in which we especially look to the National Society for assistance has to do with the practice of certain individuals calling themselves engineers, who have no right to do so and whether the industrial, mechanical, electrical or any other branch. Lately there has come to our attention the fact that certain technical institutes with very abbreviated courses are using these designations without any qualifying adjective to indicate that their graduates are only technicians and not fully trained engineers, and we sincerely hope that we will be able to work out a plan for you to assist us in putting an end to such practices.

Although I could devote much more time to a discussion of the basis of cooperation between professional and technical societies I believe that the foregoing establishes the pattern as we see it and I would like to proceed to a brief discussion of what we are doing and hope to do in the future to open and extend the actual cooperation.

First of all, we are encouraging all student members of the American Institute of Industrial Engineers to take the engineer-in-training examination as soon as possible. Preferably immediately upon graduating from their engineering course. Secondly, we are endeavoring to limit our membership to individuals who either have at present time or will ultimately have the necessary qualifications to obtain registration and thereby be eligible for membership in the National Society. Thirdly, we plan to give publicity through our official publication, The Journal of Industrial Engineering, to the desirability of being registered in order that men who are employed by industry and who have not yet seen the advantages of obtaining registration even though they have been well trained and long enough in practice to be eligible for registration, will do so. We plan to continue to preach professional attitudes and behavior to the end that our members, even though they may be dilatory in taking the step of becoming licensed engineers will nevertheless be professional engineers in every other respect.

Now, I would like to tell you just a little about the success of the American Institute of Industrial Engineers. It was formed about one year ago by a group of Ohio State alumni who immediately began a mail campaign to induce other industrial engineers to join the organization. As already indicated, the requirements for membership were made high and to our gratification this has appealed to all industrial engineers who heard about the organization and we now have approximately 300 members scattered all over the world. Some being in Portugal, India, Canal zone, Hawaii and elsewhere. As already indicated, it was determined at the outset that for matter of interest all engineers the new group would attach itself to the National Society of Professional Engineers. In some ways you might say that it was a matter of a foster child adopting a parent and moving in with him without taking the trouble of obtaining that parents consent. Fortunately however, when Mr. Van Praag, 1948 president of the ASPE, was in Columbus, he visited the American Institute National Headquarters, discussed the project thoroughly and gave it his presidential blessing.

From the outset it was decided that one of the best things that the new institute could do to help the Industrial engineering branch of the profession, would be to work with students who are trying to become industrial engineers. Accordingly, it was decided that student chapters would be organized but only at those institutions having curricula in industrial engineering accredited by the Engineers Council for Professional Development. Moreover, it was decided that students should not be expected to carry the work of the national society, consequently, dues were fixed at a very nominal

Cont'd on Pg. 12

About the AIIE

AIIE is the National Technical Society for Industrial Engineers. It is made up of engineers doing work in time study, wage incentives, standard costs, methods engineering, job evaluation, production control, personnel administration, organization structure control, and other related phases of Industrial Engineering. It is the pioneer in recognizing the difference between a professional society, such as the National Society of Professional Engineers on one hand, and the primarily technical society on the other.

The Institute adopted the general aims of the N.S.P.E. because it approved of the fine work done by that body in the field of professional registration of engineers, and its promotion of ethical practices.

MEMBERSHIP IN AIIE identifies the Industrial Engineer as a person of professional caliber engaged in a branch of engineering of constantly increasing prominence. It provides a fraternal meeting ground for Society members at local chapter meetings, at conferences and through the mail. Finally, it provides an excellent opportunity for members to exchange knowledge in the Journal.

THE CODE OF ETHICS of the AIIE shall be the Cannons of Ethics of the National Society of Professional Engineers.

THE NATIONAL ORGANIZATION of the AIIE consists of an association of all the members, divided into regions, as specified by the Executive Committee. The day-to-day operation of the affairs of the Society are conducted by the officers and Board of Trustees, within the limitations provided in the Constitution and By-Laws. Copies of these documents are available from the National Headquarters upon request.

LOCAL CHAPTERS are "outposts" of National Headquarters. Details regarding the establishment of locals are taken up on pg. 5 of this issue.

STUDENT CHAPTERS are chartered at schools having Industrial Engineering curricula accredited by the Engineer's Council for Professional Development. Exceptions are made in cases of schools having a pending accredited status.

In recognition of the great importance of the Industrial Engineers of the future, the Institute has made very liberal provisions for Student memberships and for easy transition on graduation from Student to Junior membership status. Student members enjoy the same benefits as Junior and Senior members except that they do not have an active voice in voting and business of Local Chapters and the National Association.

Membership Certificates

Many of our members are fortunate in having offices, or space in home studies where they would like to display a certificate showing their membership in an exclusive technical society. This need has now been met. A beautiful certificate has been designed and is being printed. This will bear the corporate seal of the American Institute and anyone who can do so will be proud to display it.

Use the new combined order for membership pins and certificates to place your order. Please be sure to spell your name exactly as you wish to have it endorsed on the certificate. The size selected was 8 x 10 inches for standard frames are readily available at low cost. It will be printed on a heavy rag stock ledger paper. The price of one dollar covers only the cost of manufacture, endorsing and mailing.

MEMBERSHIP REQUIREMENTS are designed after the standards of the ECPD because of the fine work done by that group in accrediting engineering curricula. There are four classes of members, as provided in Article IV, Section 2 of the Constitution:

A. Student members shall be regularly enrolled students of accredited curricula in Industrial Engineering. Student members may transfer to Junior membership upon graduation.

B. Junior members shall be engineers-in-training engaged in Industrial Engineering work or graduates of engineering curricula accredited by the ECPD and engaged in Industrial Engineering practice. Junior members may transfer to active membership upon receipt of their professional license or upon the attainment of five years of professional Industrial Engineering practice.

C. Active members shall be state licensed professional engineers engaged in Industrial Engineering practice or other persons who can present proof of long experience in Industrial Engineering practice.

D. Fellows shall consists of a small group of outstanding leaders in the profession, who are to be honored by being elected to this grade of membership. Fellows must have given at least 15 years of service to the Industrial Engineering profession and shall be selected by the Executive Council and approved by the National Convention. Not more than five per cent of the total membership is to be admitted to this group during any one year, the total number never to exceed ten per cent of the membership. The start of this group is to be left to the discretion of the Board of Trustees.

For any additional information, write to the National Headquarters, 214 Industrial Engineering Building, the Ohio State University, Columbus 10, Ohio.

Membership Campaign

The American Institute of Industrial Engineers can deservedly boast of its fine membership record since its inception fourteen months ago. The idea of the Institute brought immediate response. Hundreds of Industrial Engineers immediately sensed the need and possibilities of the organization and applied for membership. In order for the Institute to be effective in the purposes for which it was created, it is necessary that there be continued growth of membership. It is therefore essential that all existing members as well as incoming members undertake the personal responsibility of contacting qualified membership candidates. The National Headquarters will send application blanks and descriptive literature to members or directly to candidates.

It is to be understood that there is no desire to lessen the quality of the Institute by taking in any and all seeking to join. On the contrary, it has been necessary to decline the applications of some candidates. There are, however, thousands of fully qualified Industrial Engineers who have not learned of the Institute. There are also many others who are withholding application until they are fully convinced the Institute is a "going concern."

The National Headquarters is continuing its part of the membership campaign. Rosters of Registered Professional Engineers are being called from the various states. Letters with membership application blanks are being sent to those engineers who have qualified in the field of Industrial Engineering. Unfortunately, however, this procedure is not very thorough, since many of the states do not designate the branch of engineering in which the engineer is qualified. It is therefore requested that Institute members assist the National Headquarters by sending in lists of Registered Professional Engineers designated as Industrial Engineers or engaged in Industrial Engineering work. Those members residing in state capitol cities can be especially helpful in this effort.

It has been found that lists of alumni engaged either directly or indirectly in Industrial Engineering work, provide a good source of potential members. Members who have access to such information at colleges and universities can contribute greatly to the membership campaign by preparing such lists and sending them to National Headquarters.

As can be noted in the Table of Membership Statistics on page 4, the Institute has many more Student members than it has Senior members. This is considered to be a favorable sign of the ultimate strength of the organization, since a great number of the Student members are expected to become Junior members upon finishing school, taking advantage of the one year extension of the nominal Student member dues during the first year following graduation.

The American Institute of Industrial Engineers is destined to take its place beside the other great professional engineering societies. One of the major requirements for realization of this objective is getting names on the rolls. Let us, therefore, make it a point to pass on the good word to all potential membership candidates.

Local Chapters

Experience has proved that local chapter meetings provide an excellent medium for professional development of the engineer. Institute members in several cities have already established local chapters which are reported to be functioning with great success.

There are many advantages to be gained in the formation of local AIIE Chapters. The meetings, usually held monthly during the fall and winter, make it possible for members to discuss Industrial Engineering problems of mutual interest and to exchange ideas. Special papers are presented by members in some of the meetings. Occasionally guest speakers are called in. In some cases a dinner precedes the regular meeting. The dinner starts around 6:30 and is optional and separate from the regular meeting which begins around 8 o'clock.

The establishment of local chapters is a rather simple process. Upon request, National Headquarters will provide the names and addresses of members in a given locality. Ten or more members convene and vote to form a local chapter. Officers are elected and a constitution is drawn up. Samples of various local chapter constitutions are available from National Headquarters. Upon completing the constitution, the local group petitions the National Headquarters for a local chapter.

It should be apparent that there is no greater opportunity for the advancement of the Industrial Engineering cause than the local Institute chapter meetings. The meetings are invaluable not only for the purpose of exchanging Industrial Engineering knowledge but also as a basis for fraternal association of Institute members. It is therefore suggested that Institute members not presently associated with local chapters avail themselves of the opportunities therein, either by joining the nearest local chapter or seeking the formation of the same.

ALPHA PI MU

On January 25, 1945, Alpha Pi Mu, Industrial Engineering Honorary Fraternity, was officially founded on the campus of the Georgia Institute of Technology.

The field of Industrial Engineering has made tremendous strides in the past few years. Today it occupies a very vital place in the industrial world. Schools of Industrial Engineering are of major importance in engineering colleges throughout the country.

In view of these facts, a group of Industrial Engineering students on the Georgia Tech campus felt that there was a definite desire and need for an Industrial Engineering Honorary Fraternity, not only to aid in the promotion of a more cooperative and kindred spirit among men in the field, but also to give recognition to outstanding undergraduate and graduate students of Industrial Engineering as well as those men who have distinguished themselves through their work in the field in general.

With this in mind, Alpha Pi Mu was founded locally. The standards of membership are high, requiring that the candidate excell in scholastic ability, leadership, character, and achievement. The first initiation was held on March 10, 1949.

In addition, plans have been carried forth to establish Alpha Pi Mu nationally. A National Charter is now pending. Invitations are being sent to all schools having an Industrial Engineering curriculum, or a comparable four year course accredited by the Engineering Council for Professional Development, to organize local chapters on their respective campuses and affiliate with the national organization as soon as possible.

Membership Pins

As can be seen on the mast head of page 3, the Institute's official insignia is both attractive and interesting. It was selected in a contest in which members submitted suggested designs to an appointed emblem committee. The torch of the symbol represents the light of knowledge while the hourglass denotes time, which of course is of primary consideration to the Industrial Engineer. The shield, in addition to providing a background, represents the Industrial Engineering profession protecting the processes of production in the interests of society.

The Institute has arranged for membership pins bearing the official insignia at a very nominal cost. These pins are of beautiful design and are similar to the mast head of page 1. There are three types of pins; the pin-on type, the lapel button type and the eyelet type which can be attached to the watch chain. These three types are available in two compositions; yellow gold filled priced at $1.75 postage and tax included, and ten carat gold at $2.75 postage and tax included. The order blank inserted in this issue is to be used in ordering membership pins.

Ohio State Chapter Alpha Pi Mu

On Saturday May 7, 1949 a team of seven student members and Professor Wilcox, an honorary, from the Georgia Tech Chapter visited Columbus and installed the second chapter of Alpha Pi Mu at Ohio State University, Department of Industrial Engineering. A class of 23 students and 4 honorary (faculty) members was initiated in the afternoon and a very enjoyable banquet gathering was held in the evening.

Members of the visiting group were, George Lane, Charles Fiveash, B. L. Brook, W. R. P. Wilson, James L. Elrod, E. R. Hunter, Bill Granberry, A. N. Boissy, Alan E Thomas, and Ernest Sturgis.

Plans were discussed for development of additional chapters at other schools having accredited curricula in Industrial Engineering. It is the feeling of all who participated that this move marks another long forward step in the growth and recognition of Industrial Engineering.

Cont'd from Pg. 9

fee of $1.00 per year in the student classification and provision was made that a student graduating and thereby automatically becoming a junior member of the senior society could still continue for this nominal rate of $1.00 which incidently is the subscription price for the Journal of Industrial Engineering. At the present time, we have nine student chapters with the total of 600 members.

According to the 1940 census there were 9000 individuals in the United States calling themselves Industrial Engineers. We suspect of course that a goodly percentage of these may have been stop watch jockies or other technicians who appropriated the title of industrial engineer. But after making allowance for such cases and for possible growth there are no doubt in excess of 5000 real industrial engineers in the country. Our problem is to locate them. Unfortunately, many of the directories published by state boards of registration which have come into our possession so far do not indicate what branch a registered professional engineer practices in. We have made some progress by obtaining alumni lists from the colleges and some large industrial companies have furnished us lists of their employees, but we are handicapped in our membership campaign by lack of knowledge of who and where the qualified industrial engineers are.

In conclusion I wish to thank the Board of Trustees for the privilege that I have enjoyed of talking to you this evening and express the assurance that the American Institute of Industrial Engineers will make every effort to foster cooperation between the professional and technical society in every way that can be thought of by members of either organization.

Who's in Industrial Engineering

One of the greatest services the Institute can render its members is to furnish a means whereby members may become acquainted with each other. The Institute is therefore making plans to ultimately publish a book entitled Who's In Industrial Engineering. This will be something more than a membership dictionary; it will include a brief biological sketch of each member. It is expected that this book will also be of service to employers desiring accurate information pertaining to the academic and industrial background of Institute members. A sample of the information to be given in the book is shown below.

In order to provide the information necessary for the directory, each member is requested to completely fill out the Who's In Industrial Engineering Information Blank inserted in this issue and mail the same to the National Headquarters. Just prior to the printing of the book, members will be asked to provide information regarding change of employment since submitting these information blanks.

Who's in Industrial Engineering
Sample Entry

DOE, John H., Ind. Engr.; res. 15 Elm St., Pittsburgh Pa.

Ind. Engr.; b. St. Louis, Mo., July 17, 1910; S. Richard and Mary (Brown) Dow; end. Ga. Tech, Atlanta, Ga., B.I.E.; Columbus U., N.Y., M.S. in I.E.; m. St. Louis, Mo. June 6, 1935, Helen Roe; ch. Helen Louise 1939, Wm. Ernest, 1949; exper. Student Engr., G. E. Co., Schenectady, N.R., 1935-42; Sr. Ind. Engr., Ajax, Inc., Pittsburgh, Pa., 1942-45 and Chief Ind. Engr. 1945-date; member, AIIE; Tau Beta Pi; Sigma Xi; Reg'd Prof. Engr., Penna; Author Time Studies for Non-Repetitive Operations, Factory, Vol 1110, No. 4; Putting Inspectors on Incentive, Journ. of Ind. Engr., Vol. 12; (book) Job Evaluation, McGraw-Hill, 1947.

Chapter Charters

In response to many requests, Charter certificates have been prepared and will be forwarded to each chapter as soon as they are delivered by the printer and properly endorsed with the name of the chapter. It has not been possible to design this to contain the names of the Charter Members. Some of the chapters have had as many as one hundred such members. However, where the group is not too large there will be ample room for the organizing group to sign the margins of the certificate.

Where it is not possible to put the names on the margin, a supplementary form will be provided by the National Headquarters for any chapter which requests it.

Selling Industrial Engineering

One of the most frequent comments in letters from members is about the necessity of selling Industrial Engineering. These letters reflect the general feeling that the field of Industrial Engineering would well benefit from some public relations work. Many companies are aware of the need of men capable of establishing "scientific methods" but are unfamiliar with the requisites necessary for accomplishing these ends. This is frequently evidenced by company scouts who interview mechanical engineers, then proceed to describe the academic qualifications desired which are highly stressed in the Industrial Engineering curriculum. At the other extreme, there are those who hire commerce or business students to train as "Industrial Engineers."

There is nothing amazing about this situation to those who have been in Industrial Engineering for some time. Industrial Engineering is one of the more recent branches of engineering and is necessarily going through the same development "growing pains" experienced by electrical engineering, when this branch set itself separate from mechanical engineering. Going back even farther, the original engineers were military or civil engineers. The machine age, however, necessarily converted many of these engineers to the specialized field of mechanical engineering. Of course, the advent of mechanical engineering as well as electrical and more recently Industrial Engineering was greeted with scoffing and scorn.

Most industrial Engineers are sold on Industrial Engineering and are certain of its ultimate station in society. To the unfamiliar or "doubting Thomases", however, it would indeed be helpful to seek the answer to "What is an Industrial Engineer?" from those large well established industrial concerns who readily credit Industrial Engineering's scientific methods as being a principal factor in their success.

The Institute is determined to do everything in its power to dispel the cloud of uncertainty and misunderstanding regarding Industrial Engineering. The Journal will be very effective in this objective, since it is to be mailed to the crucial points in industry. Even more effective, however, will be the members of the Institute, selected on the basis of their true merits as Industrial Engineers. Each member will avail himself of every opportunity to convey the real meaning of Industrial Engineering to the public and thereby hasten the day when our profession will be unquestionably recognized by all as an essential, specialized branch of engineering.

Cont'd from Pg. 7

Reports showing actual issues, completions and availability are sent to the control room every day, and are posted in blue, red and green solid lines. Comparison of the broken and solid lines of each color shows whether or not each phase of the work is progressing according to schedule.

Any marked deviation from the plan, which causes a continued increase in the number of available jobs indicates that shop manpower and facilities must be increased or that part of the work must be sub-contracted. If the number of available jobs shows a consistent downward trend, the flow of work to the shop must be increased or personnel must be shifted to other work.

The flow of work through the purchasing department is shown on still another line graph, which is similar to that used for the detail parts manufacturing department, except that no schedule lines are shown. Progress of the work is expressed in numbers of purchase requisitions converted into purchase orders placed with materials suppliers.

The purchasing department is authorized to purchase materials by the requisitions it receives from the materials control department. Each day a report is sent to the control room. This report shows the number of requisitions received, the number for which orders have been placed, and the number on hand but not covered by orders to suppliers. These figures are posted to the graph in blue, red and green lines, respectively. Prolonged upward or downward trends in the backlog show the need for increased personnel to process the requisitions or for increasing their flow to the purchasing department.

A pictorial or positional chart is used to show the status of the work on the assembly floor. This chart is simply a modification of the floor plan of the assembly building. The various assembly positions and fixtures are indicated by black blocks or by silhouettes of airplanes. In addition silhouettes are shown to represent ground test and flight test operations, and deliveries of finished ships.

Daily reports which show the movements of assemblies and ships through the various positions are posted to the chart by means of cardboard tags. Each tag has a ship number on it. The tags are moved about as the assemblies and ships move. Tags of different colors are used to indicate the actual progress of the work. Assemblies or ships ahead of schedule are represented by green tags, those on schedule by white tags. Red tags indicate items behind schedule, and red tags with horizontal white stripes identify assemblies or ships on which work has stopped due to shortages of parts.

Assembly time cycle charts are prepared for each major airplane section, such as center wing, forward fuselage, outerwing and so forth--and for final assembly, ground test and flight test. These are bar chests. Ship numbers are listed at the left and right sides of the chart and date strips are printed across top and bottom. Opposite each ship number a black tape is attached, extending from the scheduled starting date to the scheduled completion date in accordance with the master production schedule.

The actual starting and completion dates for these assemblies and tests are posted from daily reports which are submitted by the departments responsible for the work. When an assembly is actually begun, a red tape is started on the chart for it, under the black tape previously attached. The red tapes are extended every day until the work they represent is completed. On the completion date, a green tip is attached to the red tape to distinguish the completed tape from those which are still in progress.

The time cycle chart shows past and present performance, and makes possible the forecasting of trends in the work covered. The black tapes are attached before the chart is mounted. The ends of these tapes form a pattern similar to a graph line. The red tapes should duplicate both the pattern and the date strip location of the black tapes. Red tapes which extend to the right, beyond the black, show assemblies or ships that are behind schedule. When the red tapes begin farther to the right than the black tapes, the need for corrective action is indicated.

The great number and variety of charts maintained in the Control Room precludes a full discussion here. Those mentioned deal with problems widely encountered in industry. Other, such as those concerning the control of engineering design changes, or "growth" charts showing the interlocking sequence of operations on pilot or first-run ships, are particularly applicable only to the manufacture of products as complex and as subject to change as are aircraft.

Photos: P-32255, 57, 58, 59 & 60.

Students' Management Conference

Alabama Student Chapter has pointed the way by holding the first Management Conference since the establishment of the Institute.

On April 8 and 9, at the University of Alabama, Students from the Universities of Alabama, Florida, and Tennessee, Georgia Institute of Technology, Mississippi State College, and Alabama Polytechnic Institute gathered under the joint auspices of the Student Chapters of AIIE and SAM for four sessions of papers and a banquet meeting.

At the first session on Friday afternoon, two papers were presented, Charles Flynn, of Mississippi State College, on the subject of "College Training for A Career in Management," with Harold D. Haldeman of the University as discussion moderator. The second speaker was Don Brown of the University of Florida, with Wm. A. Granberry of the Georgia Institute of Technology as moderator on the topic of "Industrial Promotion Research".

At the Banquet Friday evening, Dr. Henry G. Hodges, management engineer and former Dean at the Air Force Institute of Technology, Wright Field, spoke on "Method Improvement". Mr. Cade Verner, Jr., President of the SAM Chapter, presided. On Saturday morning Mr. Lewis Johnson of the Alabama Polytechnic Institute spoke on "The Advantage of Applying Color Dynamics in Industry Today." Mr. Chris Kyle, of the University of Alabama moderated. The next paper, entitled "Management in Industrial Relations" was presented by Mr. David Atkins of the Georgia Institute of Technology. The moderator was Mr. E. S. McBride of the University of Tennessee. The last paper of the morning session was presented by Mr. E. M. Bartee of the University of Alabama who spoke on "What is the Nature of Our Time-Study Problem -- Scientific, Administrative, or Selling?" Mr. R. H. Rueff, Jr., of the Mississippi State College, was the moderator.

The afternoon session consisted of two papers. Mr. A. E. Thomas, president of the Georgia Tech Chapter of Alpha Pi Mu, spoke on "Industrial Engineering Honorary Society," Mr. Rhett Ball, management consultant, Methods Engineering Council, Inc., presented a paper entitled, "We've Just Come Around the Corner," a discussion of the importance of reducing costs during a period of lowering retail prices. Mr. Joseph Hoffman, Chairman of the Student Chapter of the AIIE, University of Alabama, presided.

All of the meetings were well attended and the consensus was that the idea of a conference by and for students is very well worthwhile. Work has begun immediately to arrange for a 1950 "Southeastern Conference" to be held at Georgia Tech.

★ ★ ★

Men Available for Employment

Companies interested in any of the men listed below should address them in care of the office of the Journal of Industrial Engineering.

S49-1 Industrial Engineer, Experienced factory manager, Minimum salary required $8,000. Detailed information upon request.

S49-2 M.E. from Cincinnati, M.Sc. (I.E.) from OSU, is looking for an opening in process engineering or editorial work. Varied background includes three years with a large mid-western machine tool manufacturer; in research; in advertising; editing a magazine and two years as instructor of Industrial Engineering at a large University. Salary open. Location in a larger city preferred. Applicant is willing to accept propositions involving foreign service. He speaks, reads and writes German fluently and has some French.

S49-3 B.S in M.E., M.S. in I.E. Formerly employed as record engineer with home appliance manufacturer, duties included technical research, report writing and production liaison work. M.S. thesis in personnel area. Special work in personnel research, labor problems and related fields including quality control. Prefers work in industrial supervisory nature or in public or industrial relations. Will consider any location in the U S. Minimum Salary required: - $4500.

S49-4 Age 25, single. Experience in production control, scheduling, routing and expediting of special engineering products. Desires to become connected with progressive concern in sales engineering or in production engineering. Salary requirements depend on opportunity for advancement and location.

New Folder Describes Micro-File Equipment

A new, 8-1/2 x 11-inch, 12-page pamphlet, describing Kodagraph Micro-File equipment for business and industry, has been published by the Eastman Kodak Company and is available without charge from Kodak's Industrial Photographic Division, 343 State Street, Rochester 4, New York.

Profusely illustrated, the pamphlet describes four models of Kodagraph Micro-File machines, as well as the Kodagraph Micro-File Reader, Enlarger, and Projector.

The Kodagraph Micro-File Film Unit, used with the Kodagraph Micro-File machines, automatically exposes and advances the film, contains a field indicator which shows the exact area of the document which appears on the film, and can be adapted to use 16mm. film -- either perforated or unperforated -- as well as the standard 35mm. film.

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More Breakeven Charts

Reviewed by Loring G. Mitten

THE ECONOMICS OF INDUSTRIAL MANAGEMENT (451 p.) - Walter Rautenstrauch and Raymond Villiers - Funk & Wagnalls ($5)

The recent shift from buyer's to seller's market and increase in competition in many lines of business should add the exclamation point to this book's principal contention -- consistently profitable operations can be assured only through rational analysis and management of the financial affairs of a business. The authors attack three phases of the problem of rational management in the three sections into which the book is divided.

Part I, entitled "Visualizing the Business", deals with the application of the break-even chart to various economic problems. It also includes introductory material which provides a background for understanding the construction and use of the break-even chart. This section is well developed and presents a number of fairly detailed actual case histories illustrating the practical utility of the methods advocated by the authors.

Part II, "Industrial Cost Characteristics", treats interest and depreciation calculations, classification and allocation of expenses, and methods of choosing among alternatives. The last subject, choosing among alternatives, is probably the weakest part of the book: too much has been attempted in too little space and the chapter is replate with formulas which simply invite misapplication. The rest of Part II gives an adequate treatment of fairly standard material.

Part III, "The Business as Part of the National Plant", is a brief exploration of some of the relationships between the individual enterprise and the economy as a whole, covering such topics as inflation, production and demand, and industrial expansion. Several interesting techniques are outlined for the analysis of factual date relating the individual business to various elements of the economy as a whole.

The book is very practical throughout and should prove quite convincing even to those industrial managers who still feel that analytical methods, such as the break-even chart, are "new fangled" and essentially valueless in dealing with practical problems.

Both the value and the weakness of the book stem from the wide scope of subjects which have been included. Many different aspects of financial management have been brought together so that the relationship among them can be grasped, but in some cases this integration has been achieved through sketchy presentation and explanation.

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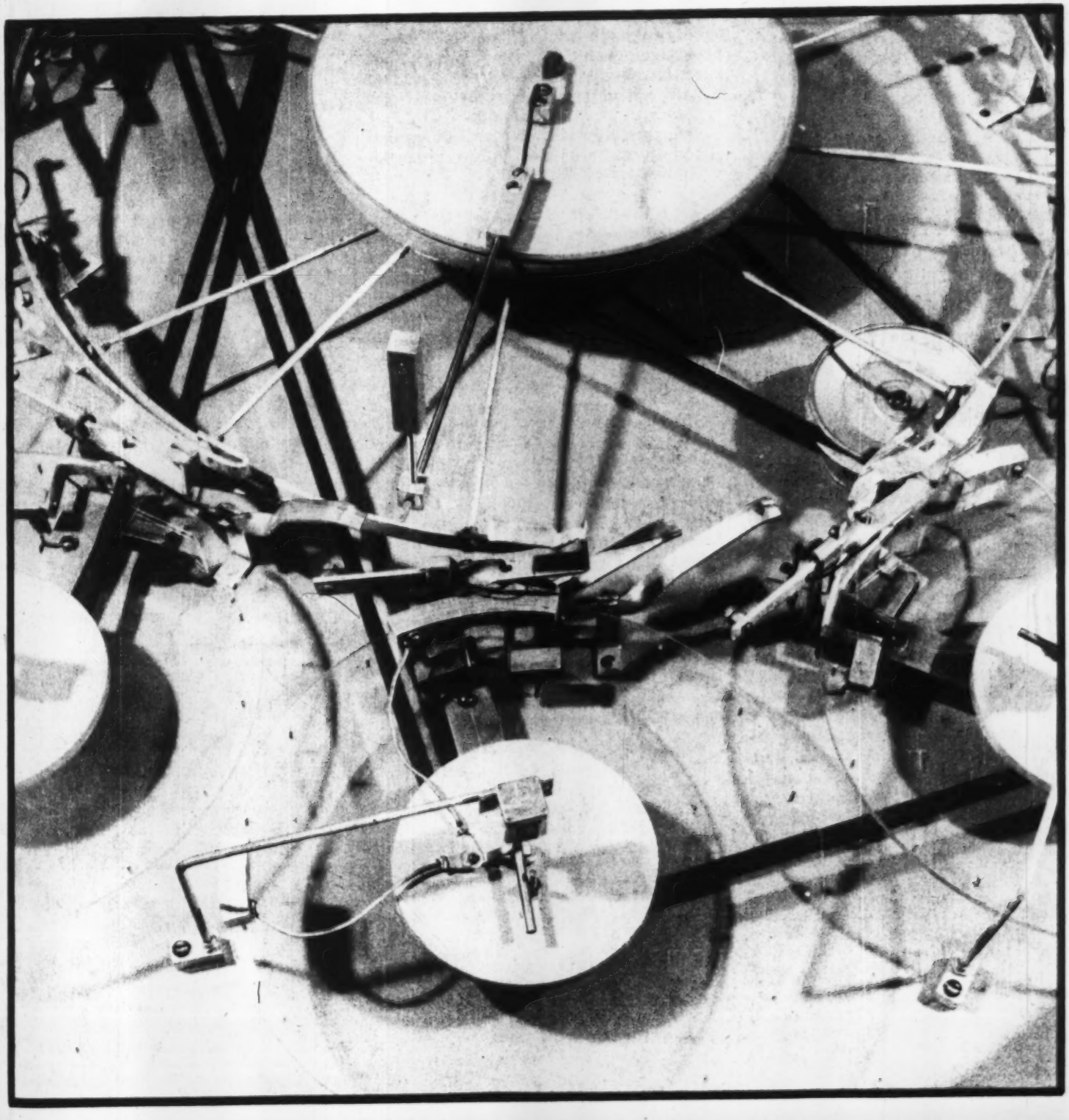

EDITOR'S PAGE

What Do Industrial Engineers Do?

The Industrial Engineer makes surveys of how industrial plants or businesses are organized and operated, and on the basis of such studies he prepares recommendations to executives for changes in the way things are made or in the set-up of the firm that will lead to better use of employees, machinery, and money in the conduct of business. He may examine and observe how equipment and how men work, make time and motion studies, study production records and products, or talk with management and production personnel. He tries to obtain a comprehensive view of any plant or business activity such as: planning and scheduling of production; production methods, standards, equipment, cost records, and control; how materials and goods are received, packed, and shipped; the hiring, training, and management of personnel; wage payment system; relation of unions to management; the system for purchasing materials and supplies; the advertising and distribution of products; and the manner in which the business is financed. He may be called upon to plan a complete reorganization; a consolidation; or to develop a design, lay-out, and organization plan for a plant or business which is to be established.

Many industrial engineers, especially consultants with long training and experience, are qualified to survey and advise on all phases of a business or industrial organization. Most of them work in a particular industry, such as an electric utility or a chemical process industry, and deal with a particular broad phase of industrial engineering work, for example, plant design and construction, plant production, sales and marketing, purchasing, personnel and labor relations, wage systems, finances, or traffic management.

Editor: The above statements were adapted from OB No. 19, NRSSP of WMC.

MANUSCRIPTS SOUGHT

The editorial board of this journal is desirous of receiving manuscripts about technical subjects of interest to industrial engineers.

ABOUT THE PRODUCTION OF THE JOURNAL

An explanation is due our members, subscribers and advertisers for the lateness of this issue and the fact that it could have been done better, although it is a big improvement on the first issue. The agency employed to do the layout work was sold out to another company. This resulted in our receiving back in headquarters a mass of page proofs, not fully complete, but too far along to permit of much changing. Although done by the same person, the strain of working for a company that could not offer security showed up in a poorer quality of work than that previously obtained.

Better things are in store! The Journal has been enough of a success that is has now attracted the attention of an experienced magazine publishing firm and arrangements are being made that will produce a great improvement in the next issue, and at no extra cost.

ADVERTISING

In this issue we are launched on the policy of carrying ads to help finance a bigger and better magazine than could be handled by dues revenue alone. Every member is urged to aid in selling space. It is a good bargain, because rates are low in keeping with our present limited circulation, (which is about 4000 copies). By contracting for space for a year companies are benefiting from the increasing circulation and readibility without increase in charges.

Write to headquarters for rate sheet and contract.

ELECTION PLANNED

Plans are now being made to conduct an election by mail in accordance with the constitution at an early date. At this stage in our development the Board of Trustees has the responsibility of functioning as the nominating committee. After there are at least three vice-presidents they will become the nominating group. It would be very helpful to have suggestions from the chapters or from individual members concerning suitable nominees.

(Continued on page 20)

A.I.I.E HONORED

On Wednesday, October 26th, the National Headquarters of the American Institute of Industrial Engineers was honored by a visit by Dr. Lillian Gilbreth.

Needless to say, those who had an opportunity to hear her speak and to visit with her individually at lunch were thrilled to have this contact with the beginnings of industrial engineering. The names of Taylor, Gantt and Gilbreth have become legendary and it seemed odd to hear them spoken of as familiar contacts.

In spite of her absorbing interest in the application of industrial engineering principles to problems of home economics Dr. Gilbreth maintains a lively interest in all other phases of the profession and expressed her pleasure to learn that the IE's own professional technical organization has been established and is growing so rapidaly.

A group of the older members propose to submit her name for election as our first "Fellow". Of course it is the association that would be honored by such an election, but Dr. Gilbreth was so gracious as to say that she would feel honored.

Professor Livingston's article explaining this chart will be found on page 14.

PERCENTAGE DISTRIBUTION OF POINTS IN INDUSTRIAL ENGINEERING CURRICULA BY FIVE MAJOR CLASSIFICATIONS

Industrial Engineering

	Min.	Av.	Max.
Basic Sci.	21	24	32
Basic Engr.	20	30/54	45
Ind. Engr.	6	17	24
Business	2	7/24	15
Humanities, etc.	15	22	31
		100	

Mechanical Engineering

	Min.	Av.	Max.
Basic Sci.	17	24	30
Basic Engr.	29	43/67	53
Ind. Engr.	6	11	16
Business	0	4/15	9
Humanities, etc.	7	18	26
		100	

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The Cover-

A Machine Interference Computer Constructed by Professor Jones

Advertising

Rates and space information on application from National Headquarters. This Journal goes to a select list and the rates are low, making a very good value for advertisers with products of interest to engineers.

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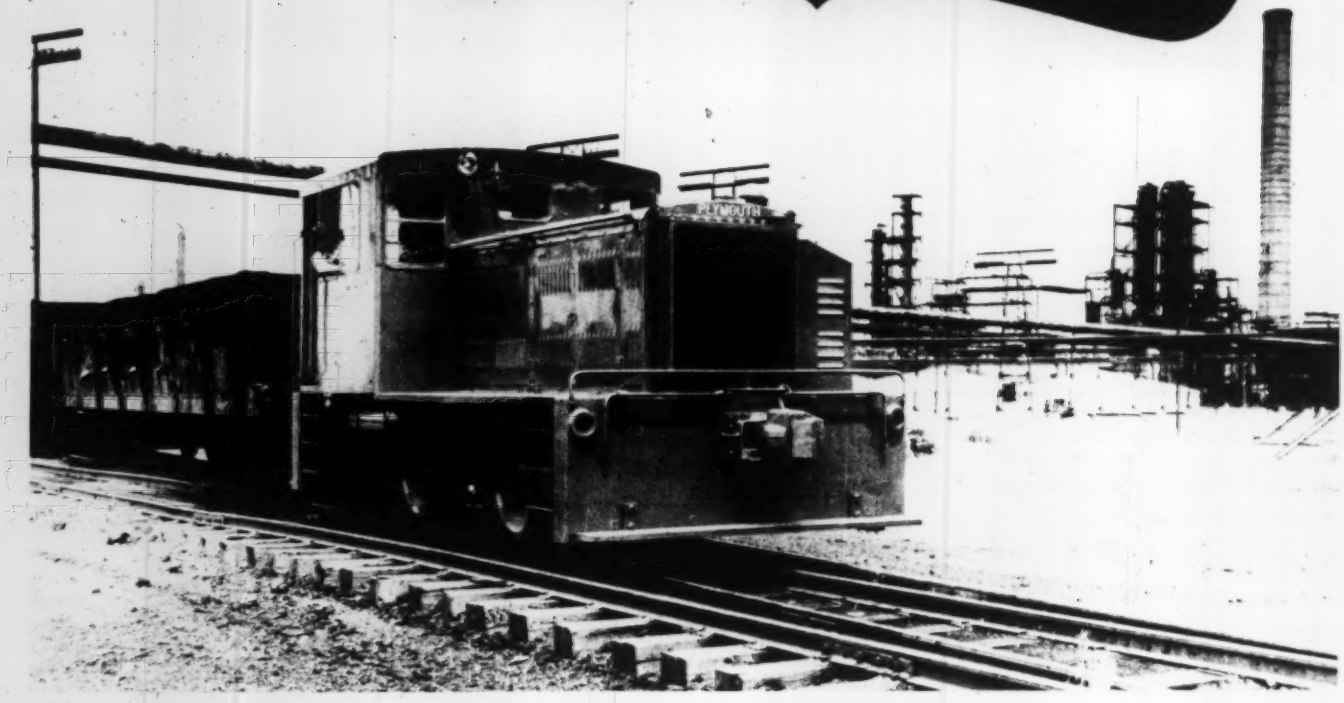

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Members of The American Institute of Industrial Engineers should address their inquiries to the attention of Thomas F. Root, B.I.E., Ohio State "46".

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PRESIDENT'S MESSAGE

With this, our second issue of the Journal of Industrial Engineering, we believe it entirely fitting that we review our progress during the past year.

Our total membership which was approximately 200 a year ago has now increased to 1600 and we have five active city chapters in operation located in New York, Cincinnati, Columbus, Dayton, and Jamshedpur, India. Additional city chapters are being organized in Boston, Cleveland, Philadelphia, Pittsburgh, Atlanta, and Rochester.

Letters were written to a number of Ohio Senators and representatives which helped in obtaining the passage of Ohio Senate Bill 329. This bill was sponsored by the Ohio Society of Professional Engineers for the purpose of amending the law providing for registration of Professional Engineers and Surveyors in Ohio. Had it failed to pass the act would have been declared unconstitutional in connection with a pending law suit for enforcement.

Representations have been made to the Board of Registration of a state which does not recognize industrial engineering. To name the state might interfere with negotiations which are in progress. Preparations are being made for a continuation of the nation wide survey of conditions of registration of industrial engineers.

We are now in correspondence with the Survey Committee of the Engineers Joint Council to induce them to list Industrial Engineers separately from all other branches in making their surveys. We have been successful in inducing the Bureau of Labor Statistics to list Industrial Engineers separately in their surveys and publications.

Every professional man should maintain a connection with his technical society. The American Institute of Industrial Engineers is our technical organization. It cooperates with the National Society of Professional Engineers which works on matters of legislation and public relations affecting all branches of engineering, and it works directly on all matters of particular interest to industrial engineers, but less important to members of other branches. Increased membership will bring increased strength. To increase membership is everybodys job.

PAST PRESIDENT'S KEY

Anticipating that some chapters may want to honor their officers on the completion of terms in office, special key designs have been obtained as illustrated above. Suggestions for alternate designs will be welcomed. These are based upon applying the present membership pin to a more or less standard background. In this manner it is possible to obtain a fine key at a reasonable cost. These keys will be made up only on special orders paid in advance by the chapter, prices are reasonable and will be quoted to chapter secretaries.

REPORT FROM NATIONAL HEADQUARTERS

Because it is still impossible to establish chapters in many parts of the country, there are many members who wonder what is happening at the national level in their organization. The only contact they have is when they receive a copy of the Journal, or have correspondence with the secretary. Under these circumstances some of them wonder if it is worth while to go on.

Definitely it is! The idea of having an association of Industrial Engineers on the professional level is so sound that letters are received each week from men who have heard of the Institute and wish to join.

There is much that the headquarters does that helps the position of all IE's that cannot be detailed in a publication. For example, during the summer correspondence with the Bureau of Labor Statistics had a part, at least, in the decision of that agency to change from listing the IE branch as merely an afterthought, treated in a couple of paragraphs under ME's in an important publication, to giving them separate treatment in the table of contents, and a chapter of their own.

Another item is correspondence with a state board of registration where it is impossible for a man to be registered in the IE branch. Progress is being made in convincing them that IE is really separate and important in its own right, and that it is not fair to require IE's to get registered as Mechanicals or Electricals.

During the summer a number of new chapters were established, in two cases the secretary traveled to attend the meetings. Day to day maintenance of the records, passing on new members, putting out the journal, including advertising solicitation, also take up a lot of time.

Thus it should be apparent that gains are being made, although it will take a long time to accomplish some of our goals. It is hoped that our members will look up on their connection from the point of view of what they can contribute, rather than merely from that of what they have gotten out of it. Also, that they contribute merely by being members until such time as it is possible for them to serve in some additional ways.

Wyllys G. Stanton.

NOTE TO EDITOR:

Dear Mr. Editor:

All during the war, John W. Nickerson and others fought to get rid of time-study prohibitions in the Army and Navy Appropriations Act. These were written in way back when F. W. Taylor was investigated.

Now there is a chance that an amendment will be tacked on that is even worse than the old one. A copy is attached. Don't you think that is vicious?

My proposal is that you write a stinging Editorial. You might point out as I have to some Senators that we applaud the Hoover approach to relief from taxes. Then we prohibit efficiency in Army and Navy. One Senator said it was to be limited to government employees. I replied that all of us were government employees in the last war.

Why shouldn't we get the most defense we can for our tax dollars?

PHIL CARROLL

A copy of the ammendment about which Mr. Carroll writes will be found on page 16. It is certainly a vicious attack upon all that Industrial Engineering stands for. Write your Congressman and Senators a protest against all such legislation. It is idle to say that it is limited to the effect it will have upon governmental employees. If this is put in for them it will soon be found reflected in all contracts for goods or services for the government, and may also crop up in the regulations of the Department of Labor and so become the standard for all employment.

Material Handling for Job Shop Production

by John W. Brantner

A recent survey of 120 diversified manufacturing plants shows that an average of about 36 cents of the production dollar was being used for the handling of materials. Even allowing for the fact that many handling movements cannot be eliminated there still exist a multitude of opportunities for improving handling methods.

Perhaps the most difficult handling problems are to be found in the intermittent and the semi-repetitive type of industry. Here the basic problems of material handling are further complicated by the inherent variety of products, small lot sizes, fluctuating work loads and many other problems to which the job shop is subjected. Through careful engineering good materials handling can be effected in these industries, however, and even though continuous handling in most cases is impractical if not impossible, the basic principles of continuous handling may be used as the criteria for developing a practical and efficient system.

DESIGNING HANDLING SYSTEM FOR A NEW PLANT

Recently, space requirements forced the relocation of a high production shop of this type. In addition to the move, a new equipment layout and materials handling system were put into effect. The basic principles of materials handling were followed in the design of the new system. Although the problems encountered here may not have an exact duplicate in other industries, they will serve as an example of how materials handling in the intermittent or semi-repetitive types of production can be put on a highly efficient basis.

PRODUCTS: This unit of the plant produces two basic products, pins and bushings. The pins range in size from 1/4 inch to 2 inch in diameter, from 2 inch to 19 inch in length, and have heads that are approximately twice the diameter of the shank. These pins are made with various types of shoulders on the shanks adjacent to the heads. In general, the bushings are hollow cylinders ranging in size from 1/2 inch to 2-3/4 inch in diameter and from one inch to seven inches or more in length.

THE PROBLEM: Although the problem in general is simply to manufacture the two aforementioned items, it is complicated by the fact that these items are produced in various grades or quality, in many sizes and styles, are made of several different metals and are manufactured to customer's specifications. About 1200 different parts are manufactured in all, being produced in lots as small as three or four and as large as several thousand pieces of the same item. Often, thirty or more different orders may be in process in this shop at the same time.

Mr. Brantner is a native of Columbus, Ohio, and is a Registered Professional Engineer. After graduating from Ohio State in 1941, he went westward to take a position with Basic Magnesium, Inc., Las Vegas, Nevada. A year later he joined the U. S. Navy as an officer on submarine duty. Four years later he took a position with Robins Conveyors, Inc. in Chicago, and later joined Jeffrey Manufacturing Co., Columbus, Ohio, where he is presently employed in the Industrial Engineering Department.

The manufacturing processes used are relatively simple. The pins are either formed directly from coil stock on a cold header or are cut off from bar stock on 4-spindle vertical cutoff machines, and then heated and headed on a hot forging machine. Various drilling, grinding and milling operations are then performed according to type and quality of pin. Bushings are made from bar stock, being drilled, reamed, chamferred on one end and cut off on 4 or 8-spindle automatics. The bushings are then chamferred on the other end, ground, drilled and/or milled according to the type or quality.

ATTACKING THE PROBLEM: In order to attack the problem, a rather comprehensive study of existing routings was made. These routings were then grouped and indicated on a flow diagram. This flow diagram was carefully studied to discover flow patterns in the existing processes. Any item which did not conform with one of the flow patterns was individually studied to determine if routing changes could be made to cause the processing to conform to the general patterns previously determined. Wherever this was possible, changes were made in the routing, and the new flow path charted.

Study of the revised chart revealed a fairly well defined flow pattern and on this basis a preliminary machine layout was made. The general order of machines and work areas was established by setting machines so that:

1. The shortest transportations between machines were obtained.
2. Back-tracking was kept to a minimum.

With the revised flow diagram and the preliminary layout avzilable, it was now possible to make a decision as to a handling system. Any system selected had to meet the following conditions:

1. Provide for movement of pieces with a minimum of manual work.
2. Allow flexibility so that a given lot could be conveniently stored between operations and any lot readily removed from storage and shifted to the next machine or work area.
3. Routing must be possible from any machine to any other machine or work area.

After considering several different types of handling systems, it was decided that a roller conveyor system would provide the best answer to the particular problems. There were, however, several obstacles yet to be overcome. Although a stationary roller conveyor could possibly be used through the primary phases of manufacture, the flow became so complex after these first few operations that a stationary roller section was shown to be impractical. This problem was solved by providing a battery powered high lift truck, shown in the accompanying illustration, equipped with several short sections of roller conveyor. When used this stationary roller conveyor at the individual machines this scheme provided the equivalent of an infinite number of roller paths interconnecting all of the machines used in the process.

(Cont'd next page)

(Cont'd from page 6)

A second problem to be solved was the discontinuity of flow after the starting operations. In the case of making bushings, for example, the first operation on the automatics was continuous, while subsequent operations were most irregular and were, for the most part batch type. This was solved by providing surge areas, as illustrated, at various strategic locations throughout the plant large enough to accumulate several complete orders.

The problem of a container was also studied at this time. There were several considerations involved in the selection of a container:

1. It must be of a size that could be easily handled when empty, easily rolled along the conveyor when full, and contain enough parts to provide a reasonable run at each operation.
2. It must be of such shape as to roll freely on the conveyor, stack for easy storage and handling with a hoist where necessary.

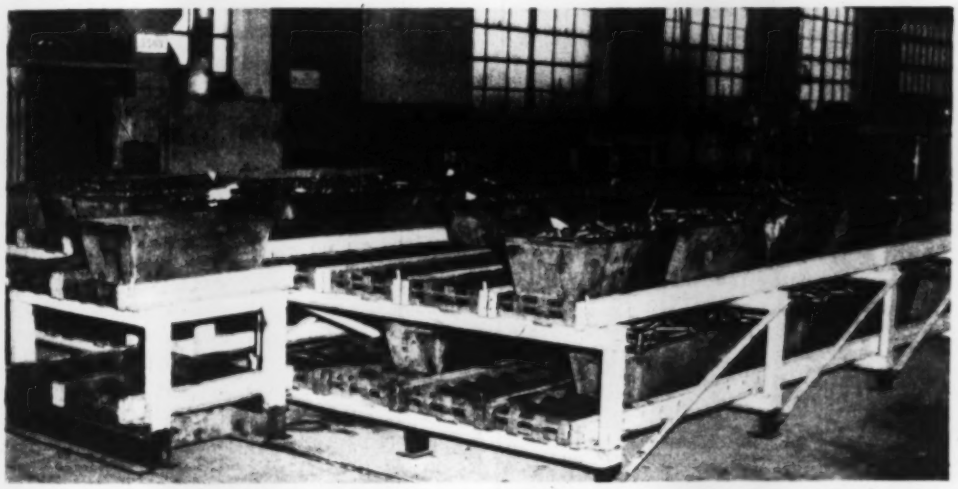
A tapered nesting tote pan of about 2.5 cubic feet capacity was selected.

It should be noted here that a few of the products manufactured in this plant are of a size and/or shape which makes it impossible to handle them by the system described herein. These products, however, are so few and are made in runs of such short duration that they can be handled conveniently by other methods and it was not felt that they should be considered in the overall plan of the system.

Loading ground bushings from grinder to battery powered high lift truck, on which they will be transported to the next operation.

With the above decisions made, it was then possible to review the routing and layout together with the handling system planned and arrive at a final layout. The machine position, the routing, or the handling system was adjusted where necessary to achieve the best overall result.

THE COMPLETED PLANT: In the finished plant, steel is delivered into the manufacturing area by means of a monorail system. The steel is placed in racks at the head of the line from whence it is picked up by floor operated hoists and delivered to each machine as needed. Approximately two orders for each machine are stored in advance in these racks.



A view of the general surge area showing one of the transfer cars which serves both sides of this section. A hoist is provided in the line for changing pans from the lower level to the upper level.

After the bar stock has been cut off on the automatic cutoff machines in the pin line the pieces are washed, deburred, and put into a surge section waiting to be delivered to a hot forging machine. The pins which are cold headed from coil stock are also washed and sorted in this area. From this surge section, the parts proceed either to the hot forging machine or to the tempering furnace. Then they are again placed in a general surge area which serves both the pin line and the bushing line.

The bushings are brought to this same area after coming from the automatics, being weigh-counted, washed and deburred. This general surge and sorting area is made up of double deck conveyor sections as shown in the accompanying illustration, work arriving on the lower level and being sorted on the upper level after washing. A hoist is provided in the line for changing elevations.

Beyond this point, all machines are fed by means of the battery operated truck equipped with roller sections. The high lift feature of this truck permits better utilization of the double deck storage section and delivers the parts at a height most convenient for the machine operator. Each machine in this group is provided with two roller sections, one for receiving parts and one for finished work. Each section is of such a

(Cont'd on page 17)

Role of the Industrial Engineer in Creating Industrial Peace

Wilson J. Bentley

The Industrial Engineer possesses a "pass-key" to the door of industrial peace: This door has been opened few times in the last decade, so its hinges are rusty and the lock difficult of operation. But, a knowledge of the operation of the lock and constant oiling of the hinges can result in the door swinging wide again. The rust is the resistance of people in different industrial strata to working together. The lock on the door is the lack of understanding of the human problems of the wage earners and the mechanical and economic problems of management.

The unlocking of this door can best be performed by the person who happens to be in a position which affords the closest contact with the existing human, mechanical, and economic problems, and who has the intelligence, personality, and desire to accomplish industrial peace.

To find the category of plant personnel which best satisfies the foregoing description, we have but to consider the Industrial Engineer and his job. Here is a man, who in the normal course of his work, moves all through the plant. Today, he may be dressed in overalls and a pair of rubber boots, spending half-day with a worker who has the most unpleasant job in the plant. Tomorrow, he may be dressed in a smart business suit, appearing before the production planning committee, or the Board of Directors of the company. Next, he may be found in the conference room conducting a foreman's training conference, or possibly, discussing plant payrolls with the company auditor. Or perhaps, he will be found in the plant cafeteria buying coffee for two or three workers and explaining a production rate he has set up for them to attain. All these activities, remember, are in this man's normal work areas. What man has a better chance to have close contact with the human, mechanical, and economic problems than the Industrial Engineer?

Happiness depends largely upon understanding. His position places the Industrial Engineer in a perfect spot to explain company policies to the workmen, as well as the human problems to the management. People must know and understand the rules by which they live and work or they feel there is no security for them.

Mr. Bentley was born in Oklahoma. After securing a degree in Industrial Engineering at Oklahoma A & M College in 1939, he spent five ane one-half years in the Combat Engineers as an Army Engineer Officer and as an advisor to Chief of French Engineers on American Engineer Material. Later, he joined Wilson & Company, meat packers, where he was employed three years as an Industrial Engineer in the Planning and Methods Department. He is now a Registered Professional Engineer and an Instructor in the School of Industrial Engineering at Oklahoma A & M College.

Whether it be the economic philosophy of Karl Marx, or Socialism, or Capitalism, the philosophies are all based upon full production. We can say that the Industrial Engineer is the creator of full production. And, in turn, full production can be a creator of industrial peace. He has the daily contacts with both labor and management and normally will have the intelligence and personality to instill trust in the sentiments of both these parties. By his persuasive power, his dissemination of information and education, and his understanding of the human problems as well as the mechanical and economic problems, he has the opportunity to be one of the greatest aids to industrial peace.

Walter W. Cenerazzo, President of a Watch Workers Union, set up a good standard for present and future Industrial Engineers when he stated, "I believe that . . . . . the Industrial Engineer must make himself a warm, human person, the type of person who can be understood by others. I have worked with time study men who had more influence in a job than any union steward or foreman, because he could sell himself to the people and sell himself to the people working on the job. That is the kind of Industrial Engineer we need more of.

In this age people seem to have an inborn distrust of any person they have neither seen nor heard. This is probably one of the reasons why our presidential candidates attempt to be seen by a maximum number of voters before an election. For top management to be trusted it should have a spokesman, or interpreter, whom the wage earners see and whom they know is mentally honest. The Industrial Engineer can establish for himself a reputation of complete honesty and fairness by adopting a high code of ethics. This code of ethics should be followed whether he be checking a production rate or investigating a petty grievance. Mental honesty in his work will need little paid advertising as the union soon discerns which man can always be depended upon to recommend a fair solution to all problems. Adherence to such a code of ethics will secure the confidence of the wage earner and management alike.

When an individual possesses the confidence of both union members and management, he is in a perfect position to disseminate education. The surest vehicle for education and information is the small conference procedure. Not only is this type of meeting a source of information, but in itself will foster better friendship and understanding among the personnel. The acceptance of education and information depends largely upon the respect felt for the instructor. The ethical Industrial Engineer will find this acceptance aided greatly by this factor of confidence. So much of labor-management difficulty stems from the lack of information! The present popular practice of many companies to try to inform the public by newspaper articles, after a strike is in progress, admits failure to give information where and when it is needed. Some strikes have stated that they had learned more than ever before about their company from the company letters and newspaper articles -- but too late.

Book Review - Management of an Enterprise

By Balderson, Brecht, Karabasz & Riddle
Second Edition 1949, 493 pp., Prentice-Hall, Inc.

Reviewed by Professor Donald B. Wilcox, School of Industrial Engineering, Georgia Institute of Technology, Atlanta, Georgia.

In this edition of their earlier text the authors have endeavored to present a new and logical arrangement of the topics conventionally included in the field of management. Addressed primarily to student as an orientation to the problems of business and industry, this textbook has little value for the practicing Industrial Engineer. The authors have spread themselves rather thin in an effort to encompass a very wide field of activity, and in many cases have used statements of broad generalities as illustrative of fundamental principles.

From the standpoint of teachability, this text has much to commend it for use in an introductory course. The discussion questions at the end of each chapter are conducive to arousing worthwhile discussion and constructive thought. The only regret of this reviewer is that there are not more of them. The authors have included a great many references to specific firms by corporate names which adds a note of realism that the average student appreciates and all too seldom finds in his textbooks. However, many of the illustrations are dark, gloomy old-fashioned photographs, detracting from the general appeal of the book.

Section I, devoted to the Fundamental Management Decisions, lays a sound basis for the following discussions on such aspects as Physical Facilities, Work Simplification, Product Design, Production Control, Budgets and Personnel. Outstanding among these are the chapters on Power and Setting of Selling Prices. Throughout the volume a consistent effort has been made to present all sides of controversial points and to illustrate the various alternative methods used by industries to tackle typical problems. The authors have included an excellent brief selected bibliography which is conveniently arranged by topics.

Robert E. Allen

Although the reviewer is inclined to dismiss this text as just another in the growing list of books treating the general topic of Business and Industrial Management, it must be admitted that a careful reading of this text will suggest new approaches to current problems and will broaden the horizon of anyone so close to the particular tree near which he happens to be working that he cannot see the woods.

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Machine Interference

by W. D. Jones

Machine interference needs no introduction to the wage incentive rate setter. He might describe it as a capricious, variable, unpredictable, immeasurable, spasmodic condition which provides eternal grounds for confusion when establishing incentive rates for products manufactured in multiple. To insure an understanding of the problem by all, however, machine interference will be taken to mean the idleness a machine experiences when it is non-productive and waiting to be serviced by the operator who is servicing another machine.

The effects of machine interference are particularly apparent in the textile industry, where each operator usually attends to several semi-automatic machines. For a given work assignment there may be times when all machines are running and the operator is merely waiting for something to happen. There are the many occasions involving machine interference, however, when varying numbers of machines chance to shut down simultaneously. In many cases there is little, if anything, that the operator can do to control the unpredictable shut downs of the machines and the consequent machine interference idleness.

The problem of evaluating machine interference losses is important to the engineer in two respects. First, machine interference loss must be known quantitatively in order to arrive at the economic number of semi-automatic machines to assign to one operator. Second, the operator's actual productive efficiency cannot be determined from wage incentive purposes until the loss of production occasioned by machine interference has been properly evaluated.

Countless hours have been spent by time study men in attempts to evaluate machine interference by use of stop watches. However, the unpredictable, variable shutdowns of the many machines involved in a given assignment make the job of recording interference time an almost impossible task. Moreover, the question always arises as to whether the period of timing was of sufficient length to be representative of the actual conditions of operation. Finally, as in regular time studies, it is always necessary to rate the varying productive efforts of individual operators. Because of the many variables and uncertainties associated with the stop watch timing of machine interference, findings so obtained are generally little better than pure guess work.

Mr. Jones is from Tulsa, Oklahoma. Upon receipt of his B.S. in Industrial Engineering, he joined R. C. A. where he was engaged in time study and methods work. Later he was employed as an Industrial Engineer at Selector Manufacturing Co., Wallace Clark & Co., Johns-Manville Corporation and E. R. Squibb & Sons. He is now an Assistant Professor in the School of Industrial Engineering at Georgia Tech. He now has a M. S. degree in Industrial Engineering and is a Registered Professional Engineer.

It has recently been found through carefully conducted experiment that the laws of probability[1] provide a valid basis for evaluating machine interference idleness in cases where the running cycles of the machines tended b y one operator cannot be coordinated. The simple formula which made it possible to construct the interference curves was derived as follows:

Let S = the normal servicing time plus allowance for fatigue, personal and minor interruptions, artificially assuming the machine on which the product is to be manufactured is to be individually tended from a point involving average walking necessary when all machines in the assignment are tended together.

Let R = the running time per unit of product. Then %s, the percentage normal servicing time to overall time when one operator tends one machine can be expressed as:

$$\%S = \frac{S}{S + R}$$

Let E = the operator's average productive effort, expressed decimally (100% ‡ 1.00), during the servicing duties.

Then $\%S_E$, the actual percentage servicing time to overall time when one operator exerts E productive effort when tending one machine, would be:

$$\%S_E = \frac{S/E}{S/E + R} \quad \text{or}$$

$$\%S_E = \frac{\%S/E}{\%S/E + (100\% - \%S)}$$

Let n = the number of machines tended by one operator.

When one operator tends n machines, machine interference becomes a factor in the operating disposition of each machine. Let %i = the average percentage of overall time each machine will be non-productive due to machine interference when one operator tends n machines, each requiring an average of $\%S_E$ percentage servicing time to overall time.

Then %s, the actual percentage servicing time per machine to overall time when one operator exerts E productive effort in tending n machines can be described as:

$$\%s = \%S_E\ (100\% - \%i)$$

where (100% - %i) is expressed decimally.

Let %4 = the average percentage non-productive time per machine to overall time when n machines are tended together; %d = %s + %i.

The probability of a given machine producing at a given moment is 100% - %d.

(Cont'd next page)

W. D. Jones, "A Simple Way to Figure Machine Downtime", Factory Management and Maintenance, October, 11946, pp. 118 - 121. This article presents a more involved approach to the problem of machine interference than the one described herein. However, both mathematical methods yield identical results for a given set of conditions.

(Cont'd from page 10)

According to the laws of probability, the probability of all n machines producing simultaneously at a given moment is $(100\%-\%d)^n$ where $(100\%-\%d)$ is expressed decimally.[2]

Similarly, the probability of one or more machines being down at a given moment is $1-(100\%-\%d)^n$ where $(100\%-\%d)$ is expressed decimally. It therefore follows that $\%s$, the average percentage servicing time per machine to overall time, expressed decimally, can be represented as:

$$\%s = \frac{1-(100\%-\%d)^n}{n}$$

Where $(100\%-\%d)$ is expressed decimally.

The above expression was used in constructing the accompanying interference curves. In preparing the curves, convenient $\%d$ values were chosen for various n values to compute $\%s$ values. Then, corresponding percentage interference, $\%i$, values were determined by substituion $\%d$ and respective by substitution $\%d$ and respective $\%s$ values in the expression $\%i = \%d-\%s$.

In its most convenient form the percentage servicing time per machine must be stated as $\%S$, i.e., on an individual machine attention basis. According to the previous definition of $\%s$; $\%s = \%S_E(100\%-\%i)$ or $\%S_E = \%s/(100\%-\%i)$. To determine the $\%S_E$ values used in constructing the interference curves it was therefore necessary to divide the various $\%s$ values by the corresponding $(100\%-\%i)$ values.

THE INTERFERENCE COMPUTER

The machine interference computer[3], shown in the accompanying illustrations, was developed to test the reliability of the machine interference curves for groups of ten or less machines tended by one operator. The equipment, which provides for the creation and accurate measurement of machine interference, consists of three components: (1) a group of ten "machines" placed in a circle, (2) an "operator" moving about the circle, stopping and servicing machines whihh shut down, and (3) a timing and revolution counting apparatus which gives the basic data necessary for computing the servicing time, running time and interference time of the machines for each test.

To date, more than 100 thirty minute tests have been conducted with the interference computer, giving results representative of approximately 500 hours of multiple machine assignment in the plant. The tests involved conditions of uniformity where the servicing requirements per machine were the same, as well as non-uniform conditions where the servicing requirements per machine varied considerably. The test results were in

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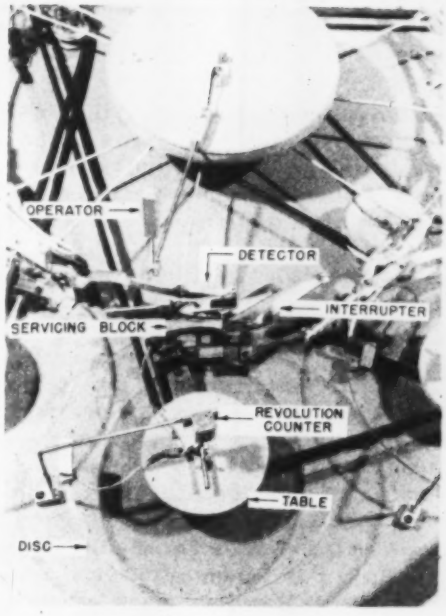


The machine in the foreground has shut down and is waiting to be serviced by the "operator," thereby creating interference waiting time. The action of the operator will be to pass counterclockwise beneath the detector, raising it and then dropping it on top of the servicing block, thereby permitting the disc to resume movement (in a clockwise direction). In the raised position, however, the detector will detain the operator. Thus, "servicing" by the operator will continue until the servicing block completes its passage beneath the detector, after which the operator will move on to the next machine that is idle and awaiting hand servicing.

The interference computer set up for time-study laboratory practice. As a student attempts to time the running disposition of the several machines attended by one operator, he readily senses the problems confronting engineers in practice. In operation, the colored bulbs light when the machines need servicing, and the white bulb of an individual machine glows while that machine is being serviced by the operator.

[2] This statement is exactly true only in cases where the $\%d$ for each machine in the group is the same. However experiments on the "interference computer," to be described, have proved that in cases where $\%d$ differs for individual machines in the group, the use of the average $\%d$ in $(100\%-\%d)^n$ introduces an insignificant error.

[3] W. D. Jones, "Mathematical and Experimental Calculation of Machine Interference Time" The Research Engineer, Georgia Institute of Technology, January 1949. This publication can be secured without charge from the writer.

Building an Engineering Career

by Robert E. Allen

Lest you may have gained the impression from the title given in the program that you were going to be treated to a lecture on proper decorum for engineers when wearing top hat, white tie, and tails, let me set your minds at ease here and now. The kind of drawing room society enjoyed by most engineers does not require an Emily Post slide rule for guidance on social guidance on social conduct. I am very happy to be here tonight because it holds a special personal thrill for me. It is my first appearance on a program of this kind on the campus since I was graduated here some fifteen years ago.

Because we have so much in common in having attended classes in the same rooms, walked the same paths across the campus, made the same mistakes and got ourselves into the same jams, I would like to ask you to trade places with me for a moment and project yourselves about 15 years into the future. You have been invited to talk to the engineering students of your college and you are pleased as punch at the idea of coming back here. Many pictures of the events of your stay flash through your mind. You recall how Chief Younger used to bring a class to a close by refilling his pipe and a cheery "That's all fellows." How the leading lady in the Quadrangle Jesters show received a little too much spiritual help between acts and in the final act had to be led on stage between two stalwart members of the chorus. She sang better than she ever did in the rehearsals.

Suddenly like a chill wind the awful fact appears that you are supposed to hold the attention of a group of fellows like yourself for 20 minutes or so. Now what can you possibly say that will make sense or that they haven't already heard before. Of course, all the trite things about the value of hard work, character, honesty, integrity, etc., that you used to hear have been proved true by painful experience, but you can't expect them to be interested in that stuff. So here you are. By now, you are probably ready to trade places again and let me sweat this thing out alone. Since we both have discovered that I'm no public speaker, we'd better forget the idea of making a speech and spend a little time discussing a few common problems. As a matter of fact, problems that aren't too important at the moment, but which might become so in the future.

As we listened to the two previous speakers so interestingly describe two areas of engineering endeavor, I'm sure all of us were thrilled to be part of the engineering profession. Engineering is one of the few constructive professions. It relies not on illness nor misfortune for its existence but it brings to everyone a better life. Truly you can be proud to be a member of this great profession that embraces so many complex and specialized fields. In spite of the difference in the various branches of engineering, most of us have much more in common than we perhaps realize. All of our work is based on the same fundamental antural laws and all of it demands the same logical approach. The same type of approach can be applied to the design of a bridge as to the installation of a job evaluation plan. In fact, you may major in one branch only to find yourself practicing in another ten years hence.

I was particularly interested in the talk on prefabricated houses, for if there is anything that America needs more than a good five cent cigar, it is a good $5000 house. I'm sure all of us would like to own a nice new house with all the modern conveniences engineered into it. Now let's suppose Lustron, by mass production methods, is able to offer houses for $5000 and we somehow have enough money to buy one. Our first problem is to find a suitable home site. We want a good neighborhood, one that is building up in value and not a slum district. It must be well located with respect to shopping facilities and other conveniences. No matter how fine the house, if it is in a poor location it will not be attractive to future buyers. Let's say we have found our lot and have our home erected on it. Here we are with a well planned, well constructed home in a fine neighborhood. Is it finished? You may think so but your wife won't. Oh, no. It must have attractive landscaping outside, and curtains, draperies, carpets, pictures on the walls and all the incidentals that make it beautiful and distinctive.

Now let's take a look at this house we are building which we call a career. I am told that today you will have a minimum of $5000 invested in your engineering education by the time you are handed your diploma. If you have planned wisely and worked carefully, you have a sturdy structure on a solid foundation with all the room that is required for expansion and growth. It is well equipped with all the essentials for a happy and constructive life.

The engineering profession is a wonderful neighborhood in which to have built your house. It is progressive, favorably regarded by other members of the community and is constantly increasing in its value to society. Here is every opportunity for your career to flourish and develop. Look around at some of the other houses that have been built here. Some are indeed beautiful, but others seem to lack something. Here's one where the shrubbery needs trimming and the lawn needs a shave. There's another with excellent construction, but the interior is so bare and unattractive. An engineer from another company in Dayton made an appointment to see me recently to talk over a particular problem. When he appeared he had no necktie, he badly needed a shave, and his suit need pressing. He certainly stacked the cards against himself in making a first impression.

Unfortunately, too many of us are so engrossed in erecting the sound framework of technical training that we fail to see the need for planning the addition of things that will round out personalities and make us more attractive to employers and the public. I attended a meeting of engineers recently and found that none of them had the most rudimentary knowledge of parliamentary procedure. Many technical men seem totally ignorant of the workings of our modern society. Things are done by groups of people working together in the interest of a common cause. You cannot accomplish much alone. This may come as a shock to you but a large segment of the public today thinks of an engineer as a man who drives a locomotive. Our deeds alone are not enough. We must still sell ourselves to employer and public alike. Successful selling requires well planned advertising and attractive packaging even though the product is excellent.

You are fortunate in attending a school that has adopted the five year curriculum to give you an opportunity to round out your training with a few courses in the cultural and business fields. I urge you also to take full advantage of the training offered by extra curricular activities. Select one

(Cont'd on page 16)

Have You Seen This?

THE NEW HOTCHKISS STAPL-ON

Here's a tool that neatly drives many sturdy staples in the time it takes to put in ONE tack with old-fashioned tack and hammer...pays for itself in saved time within days!

USE STAPL-ON FOR

Lining Shipping Cases

Tagging Shipping Boxes

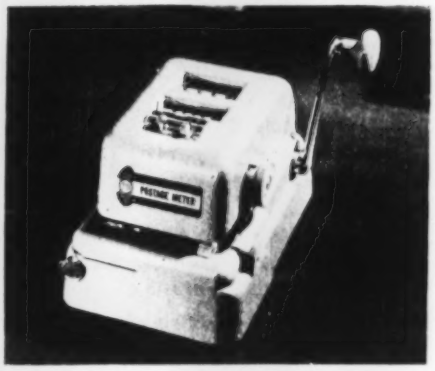
Lining Box Cars

Installing Insulation

Building Construction, etc.

The E. H. Hotchkiss Co., Norwalk, Conn.

NEW DESK MODEL POSTAGE METER BRINGS METERED MAIL'S ADVANTAGES TO SMALL FIRMS

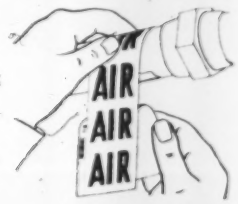


The first "desk model" postage meter, little larger than a dial phone, yet a complete metered mailing machine that stamps and seals mail of all kinds and classes, made its national debut this month in 86 branch sales-service offices of Pitney-Bowes, Inc. after six years' development and field testing.

By simply "dialing" the stamp value wanted and pressing a lever, the new baby postage meter prints postage of any value, complete with dated postmark and, optionally, the user's own advertising message, trademark or monogram. It accounts for postage used and postage on hand in visible, dollar-and-cents registers. A moistening machanism permits sealing of envelope flaps, and a detachable unit takes care of parcel post postage.

Called the "DM" model, it provides all the major advantages of the U.S. metered mail system, including faster handling and dispatch in the postoffice, where metered mail needs no postmarking or canceling and therefore can often catch earlier outgoing mail trains and planes. Pitney - Bowes, Inc., Stamford, Conn.

NEW, SELF-ADHESIVE PIPE MARKERS FEATURE FAST, ACCURATE IDENTIFICATION OF PIPING SYSTEMS



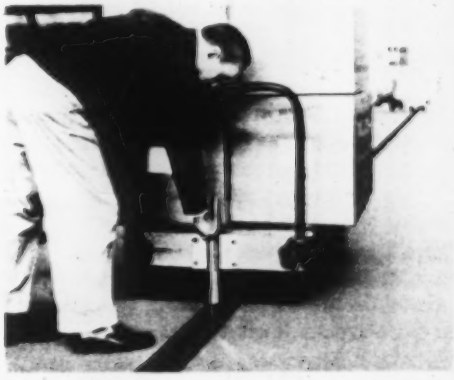
New self-adhesive "QUICK-LABEL" Pipe Markers for fast accurate identification of materials carried in pipes are announced in 4-page folder released by W.H. Brady Co., Milwaukee, Wis. The Markers conform to American Standards Association Standard #A13, "Identification of Piping Systems", compiled by ASA under the sponsorship of the National Safety Council and American Society of Mechanical Engineers. Each Marker is 2-1/4" wide by 9" long and comes mounted on a card 2-3/4" by 9".

ASA Standard #A13 establishes 5 basic background colors for classifying the major types of materials carried in pipes, with the names of the specific material in the pipe superimposed on the proper background color. The pipe markers are printed with the names of the materials in large black letters on the correct ASA background colors. The manufacturer claims the labels can be read up to 75 feet in illumination provided by a flashlight and that anyone who can read knows exactly what is in pipes marked with QUIK-LABELS.

Brady Pipe Markers are designed to replace hand painting and stenciling of pipes. Weather and water-proof, they stick without moistening to bare or covered pipes. Each card is equipped with a Starter-strip which automatically releases part of the label for fast application to the pipe to be marked. W. H. Brady Co., Milwaukee, Wis.

WEBB "TOWVEYOR"

FLOOR TYPE TOW CONVEYOR



The Webb "Towveyor" is a continuous chain conveyor with the chain running in a steel slot below the floor.

A simple towing pin device is bolted to the end of the standard four-wheel or trailer. Standard two-wheel trucks may be used with a dolly.

Trucks are set in motion by dropping the pin into the slot. One of the pusher dogs spaced at suitable intervals on the chain, engages the pin and moves the truck along the Towveyor route.

Disengaging is just as easy--by lifting the pin. Then the truck may be pushed away from the slot, handled as any hand push truck.

In practice, the "Towveyor" chain is looped around the warehouse or other area to be served. Loops can include freight loading and unloading dock, check points, etc. Trucks may be engaged or disengaged at any point. No preset stations are needed. Strength and construction are such that loads may be towed up or down hill if desirable.

No part of the conveyor projects above the floor--there is nothing to interfere with any other traffic.

Ordinary standard shop trucks are recommended--no special attachments are needed except the pin mechanism, which is easily applied. No special operators are needed--the regular warehouse crew handles trucks and conveyor. Trucks do not pile up at any point, but hold spacing as they travel around the circuit. Jeruis B. Webb Co., 8951 Alpine St., Detroit 4, Michigan.

Cont'd on Pg. 18

Industrial Engineering in Transition by R. T. Livingston

One of the most interesting recent developments in the engineering profession has been the growth of industrial engineering. From an almost unrecognized position in the profession and with small student groups in a relatively few institutions the profession has become recognized as a major contributor to the extraordinary productivity of America during the world war. Not only have the student bodies grown to formidable proportions in the institutions where there have been industrial engineering departments, but new departments are being introduced in many places in answer to a definite demand.

The Department of Industrial Engineering was established at Columbia University in 1918. It has grown from the smallest to the largest department in the Engineering School, and its course offering from approximately 75 student points to 195 in the space of two years. It is to be noted that this includes graduate as well as undergraduate courses. Believing that this is a phenomenon of real importance and worth of study, the Department of Industrial Engineering and Management has been carrying on a theoretical and practical study by its staff, certain research assistants and graduate students over the past two years. This article is the first result of these studies to appear. As various phases are completed, other articles will appear in the Journal.

There are many ways that studies can and should be made; perhaps the most obvious one is by means of questionnaires to discover what industry "calls" industrial engineering. In other words, what are the jobs that a graduate in industrial engineering can reasonably hope to be considered for upon graduation. While it is believed that such studies are of interest, it is not believed that they are truly definitive. What industry defines as industrial engineering may be a good measure of what industrial engineering is (although there is great variation in industry), but it does not tell what industrial engineering will be. Industrial engineering is in the process of a great and rapid change; a change from an art to the technique which it now is, and then to the professional science which it will be. What industrial engineering will be depends upon what the industrial engineering schools teach, and more especially, upon what the recent graduates practice, and how successful they are in impressing their abilities upon the profession and industry during the next few years.

Another method of making a study is to carefully analyze the profession and its requirements and to attempt by classification to set up a logical and coherent body of disciplines which will meet the requirements which have been set up for the profession. As far as the ultimate future is concerned, there is the proper engineering approach, but it is not a matter which can be accomplished in a short time and even such a study requires a starting point. That starting point is the "status quo"; what are the schools teaching today and how do these teachings compare with one another and with the obvious professional needs? This report attempts to answer the foregoing questions.

A study has been made of 24 industrial engineering curricula, 7 of which were options in mechanical engineering and 17 of which granted the industrial engineering degree. These schools were in the accredited list of the E.C.P.D. There are other schools which were not included at this point in the study, some because they had not yet become accredited, others because they were so young that full details of the curricula were not available, and still others because course descriptions did not permit adequate comparison. For purposes of comparison, all courses were converted to the Columbia University system, which is 1 point for one 50 minute lecture per week for a 4-month semester or for one three-hour laboratory or computation period.

The accompanying table presents the percentage distribution of points in the various industrial engineering curricula by five major classifications; basic science, basic engineerings, industrial engineering, business and the humanities or general educational courses. There is naturally a problem of classification especially as between industrial engineering and mechanical engineering and industrial engineering and business. This table indicates clearly that there is a real difference between the curricula depending upon whether industrial engineering is a separate department or an option in mechanical engineering; in the latter case there are about ten points more in basic engineering (invariably mechanical engineering and usually machine design and similar courses) and similarly less courses in industrial engineering and business. The industrial engineer invariably has a heavier load in economics, marketing and similar subjects. The first conclusion to be drawn is that the industrial engineering option in mechanical engineering is probably a course in production engineering while the regular industrial engineering course is less narrowly limited.

There is not much difference in the offerings in basic science. It is clear that the industrial engineer receives

(Cont'd next page)

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Powered by electric, gas-electric or gas.
THE ELWELL-PARKER ELECTRIC CO
4235 St. Clair Ave. Cleveland 3, Ohio

(Cont'd from page 14)

substantially the same basic training in mathematics, physics and chemistry as do students of other branches of engineering. The only question to be raised at this point is whether the industrial engineer uses these basic sciences in his industrial engineering subjects or whether they are only used as prerequisites in his courses in basic engineering.

The difference between the independent industrial engineering curriculum and that where it is an option in mechanical engineering is most clearly shown in the comparison of the mechanical engineering point totals. For the industrial engineering option in mechanical enginnering, the average number of mechanical engineering points is 26 out of a total of 43 basic engineering points, while the regular industrial engineers take 12 mechanical engineering points out of a total of 30 basic engineering points. One of the most interesting things shown is the almost complete absence of chemical engineering, a matter which deserves some consideration. With the chemical processes occupying such an important place in our industrial economy, it would seem of importance that the industrial engineer should be at least familiar with the basic processes and operations of chemical engineering.

In the field of business, a course in accounting is everywhere required as is generally a course in finance and another in law. There is a great deal of variation in who gives such courses as applies economics, personnel and cost accounting, to name a few. Whether they are offered in the business department or by the industrial engineering department is probably largely a matter of history of the relative dates of establishment and reputation of the two departments. It is believed that except for accounting, finance and law, such courses are best taught for engineers by engineers.

The industrial engineering subjects generally offered may be divided into four broadclasses: (1) Organization and management and production, (2) Economics and costs, (3) Statistics, and (4) Personnel. There is an increasing tendency to divide the field of organization and management from the general field of production. In most cases there was and in many cases still is, a general course which covers the whole field -- usually called industrial management. Without exception however, time and motion study and methods study is taught separately, with perhaps separate courses in production control and tool engineering or production method s. There is a great deal of difference as to the question of engineering economics and costs, where this subject is not taught by the industrial engineering department there is often additional course content in business.

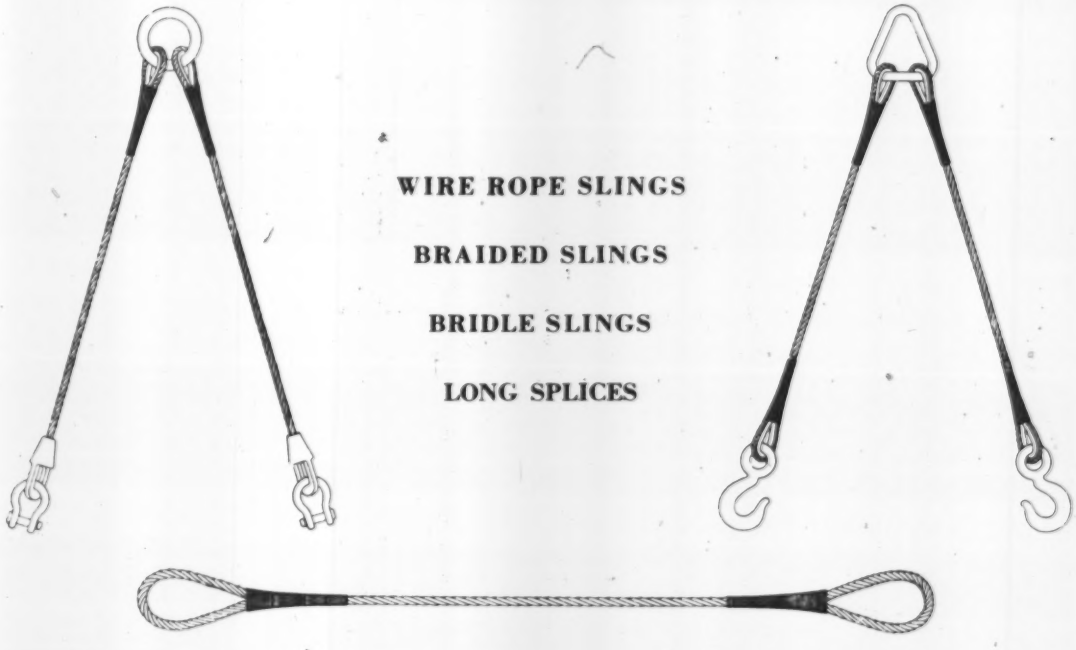
As far as the humanities are concerned, there is great variation as to required points and as to subject matter. No fundamental conclusions can be derived at this point other than to point out that ther e is more stress on the ability to write reports and to present one's ideas coherently in the industrial engineering curricula than in the case of the other branches of engineering.

Other studies have been, and no doubt still are being, carried on; two especially have come to the writer's attention which were presented at the Convention of the American Society of Engineering Education at the Rensselaer Polytechnic Institute, June 1949; "What's New in Industrial Engineering Curricula" by Everett Laitala, Associate Professor of Mechanical Engineering, University of Illinois, and "Industrial Engineering-What Is It?" by F. H. Thomas, Professor and Head Department of Industrial Engineering, University of Buffalo.

If other studies are in preparation the author would appreciate information. This is an important subject and there is so much to be done that duplication of effort must be avoided.

(Professor Livingston's Table Will be Found on Page 2)

PENNSYLVANIA SLING COMPANY



WIRE ROPE SLINGS

BRAIDED SLINGS

BRIDLE SLINGS

LONG SPLICES

260 42nd Street MAyflower 1-6537 Pittsburgh 1, Pennsylvania

DANGER!

SEE LETTER ON PAGE 5

Army and Navy Appropriations Act, H. R. 4146 was passed by the House in April, 1949 with no timestudy or incentive restrictions applying to any part of the government.

But a Senate Sub-committee on Armed Services in proposing to amend the Act as Section 630 with a much more restrictive clause than was in there formerly. The clause is intended to legally prohibit efficiency among Government employees who would include, of course, most all of us in time of war. The proposed Amendment Section 630 is as follows:

"No part of the appropriations made in this Act shall be available for contracts with any person, firm, or corporation to make or cause to be made with a stop watch or other time-measuring device a time study of any job of any employee; no part of the appropriations made in this Act shall be available for the salary or pay of any officer, manager, superintendent, foreman, or other person or persons having charge of the work of any employee of the United States Government while making or causing to be made with a stop watch or other time-measuring device a time study of any job of any such employee between the starting and completion thereof, or of the movements of any such employee while engaged upon such work; nor shall any part of the appropriations made in this Act be available to pay any premiums or bonus or cash reward to any employee in addition to his regular wages, except for suggestions resulting in improvements or economy in the operation of any Government plant; . . . ."

(Cont'd from page 12)

or more student organizations and then take an active part in them. They will yield a handsome return on the time and effort invested. It is a pleasure to see so many members of the Student Chapters of the American Institute of Industrial Engineers and the Ohio Society of Professional Engineers here tonight.

I am proud of my association with both organizations because they are setting a fine example of the proper relation between a technical and a professional society. The organization of the Medical and Legal professions is somewhat different from our own. The Medical Profession for example is represented by one over-all society. The American Medical Association. Within its framework are many technical groups such as psychiatric, obstetrical, etc. In the case of engineering, most of the technical societies were founded first to keep members of a particular branch informed of the latest developments in that field. The professional society was found later but today the National Society of Professional Engineers with over 19,000 members is larger than most of the technical groups. It has only been in recent years that the need for one organization to speak for all engineers was fully appreciated.

As a member of the City Plan Board of my home community, I have had occasion to observe the operation of zoning laws and restrictions in protecting the property values in business and residential neighborhoods. The neighborhood in which we have erected our professional houses needs similar protection. This is provided by engineers registration acts now in force in all forty-eight states and the territories of the United States. These laws prevent the shack of a shyster being built next to the residence of a properly qualified man and thus protect society from the dangers of incompetent practice.

The building of a good neighborhood for your engineering career has not taken place overnight. Our registration law in Ohio was passed just 15 years ago and has been improved by amendment several times since. There are now some 16,000 registered engineers practicing in the state as compared to 12,000 physicians and 14,000 lawyers. However, almost 100 percent of the licensed physicians and practicing lawyers are members of their respective professional societies whereas only one fifth of the registered engineers are members of the Ohio Society of Professional Engineers.

Engineers are just as apathetic in regard to public affairs as they are to their profession. The engineers on school boards, civic associations, committees for cultural improvement, etc. are few in number. Look at our friends in other professions and you will find them very active. Our Chamber of Commerce has a slogan, "Service is the rent we pay for space occupied in our community."

Too many engineers still do not realize that the value of their individual career houses in the community of society is to a large extent determined by the value of their neighborhood, the engineering profession as a whole. You have made the major investment of your life in your technical training but by all means spend a little additional time, effort and money required to add the polish and refinement to improving your neighborhood, the engineering profession.

At Last

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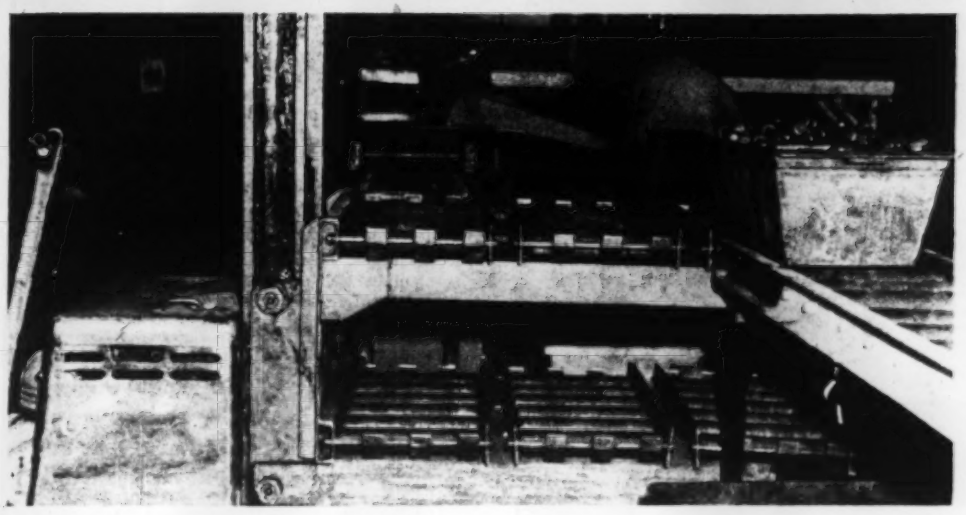


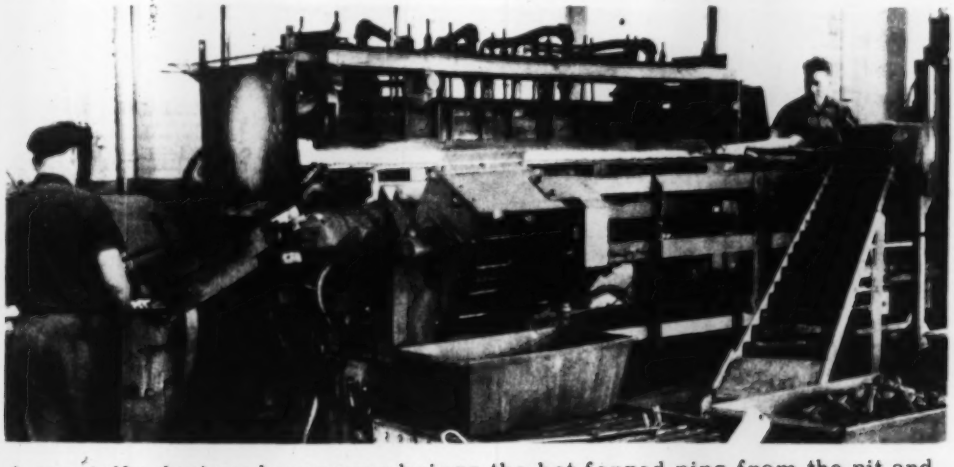
A view showing the battery powered high lift truck delivering parts to a stationary roller section.

length as to accommodate a sufficient number of pans to last the operator for the time required for the battery powered high lift truck to make its rounds. The accompanying illustrations show this truck in use as described.

Several special handling devices were designed to be used in this system. At the furnace for heating pins for hot forging, the operator sits on an elevated platform, and it is necessary to deliver parts to him at working height. This is accomplished by means of an air hoist shown in the accompanying illustration, provided with a roller section and an escapement mechanism. An apron conveyor is provided to bring the hot forging from under the forging machine and to discharge them into a tote pan at conveyor height. Other devices include air operated gates, dumpers, skip hoists, and scale sections for weigh-counting parts while on the conveyor.

As mentioned previously, the variety of size, quantity and quality of parts makes true continuous handling impractical if not impossible in this plant. An engineering analysis of the problem, however, yielded a system that, while not continuous, adheres closely to continuous handling principles. This plant has been operating for some time under this system which has proven to be satisfactory. Economies have developed both in reduced handling and in reduction of work in process. Also, there has been a big improvement in housekeeping with a resultant improvement in worker morale. This has improved product quality and reduced scrap losses.

Although, as stated at the outset, no two plants have identical problems, it is undoubtedly true that there are more plants with semi-continuous or intermittent type operations than plants where a completely continuous layout can be applied. Therefore, it is hoped that this account of an actual solution of material handling problems in a semi-repetitive plant may be helpful to other industrial engineers.



A specially designed conveyor brings the hot forged pins from the pit and delivers them into a tote pan at conveyor height. Note the roller section used to deliver empty pans to the loading point.

RECOMMENDED FOR READING

"A Proposal for the Improvement of Time Study," L. E. Davis, Assistant Professor of Mechanical Engineering, University of California, Berkeley, Cal., Mechanical Engineering, May 1949.

"Shop Participation Guarantees Successful Methods Program," C. H. Hughes, Methods Engineer, Glenn L. Martin Co., Baltimore, Md., Factory, May 1949.

"Recording Gage for Control of Quality at the Machine," C. W. Kenney, Quality Control Engineer, Federal Products Corp., Providence, R. I., Factory, May 1949.

"A Study in Effort Rating," Henry A. Schell, Modern Management, April, 1949.

"Memomotion Study Technique Simplifies Work Analysis," M. E. Mundel, Professor of Industrial Engineering, Purdue Univ., Lafayette, Ind., Factory, June 1949.

"Industrial Engineering - A Survey of Practice in 89 Plants," Ralph M. Barnes, Professor of Industrial Engineering, University of Iowa, Iowa City, Iowa, Factory, June 1949.

"The Small Manufacturing Company as an Opportunity for Engineering Graduates," Crosby Field, President, Plakice Corp., Brooklyn, N. Y., Mechanical Engineering, May 1949.

"Taking Inventory With a Camera," George Carlson, Assistant Controller, Plomb Tool Company, Inc., Los Angeles, Calif., Factory March 1949.

"Why Music Hath Charm - and Profit," George W. Dyson, Machine & Metal Trades High School, New York, N. Y., Plant Engineering, May 1949.

"Using Model to Teach Process," William B. Halladay, Training Representative, The Atlantic Refining Co., Philadelphia, Pa., Factory, March 1949.

CHAPTER MANUALS

A manual covering the organization and operation of local chapters has been prepared and may be obtained by chapter officers and those interested in working on the formation of chapters by addressing a request to the national headquarters.

PROFESSIONAL DIRECTORY

PHIL CARROLL
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MAPLEWOOD, N. J.

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Louisville 2, Kentucky
Operating Cost Reduction; Executive Personnel; Research; Profit Sharing

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204 Harrison Street
ELYRIA, OHIO
Industrial Consulting

JOHN J. HARTE CO.
284 Techwood Drive
Atlanta, Georgia
New York Des Moines
Design and Construction of Manufacturing and Chemical Plants

CHARLES VESELY & ASSOCIATES, INC.
Industrial Designers and Engineers
Design Engineering Product Development
Consumers Products Commercial Equipment Durable Goods
197 N. 123rd St.,
Wauwatosa 13, Wisconsin

JOHN L. McKEE, R.P.E.
Consulting Industrial Engineer
Box 7290 Pittsburgh 13, Pa.

WYLLYS G. STANTON, R.P.E.
2631 Chester Road, North
COLUMBUS 12, OHIO
Personnel and Management Consultant

Have You Seen This?

Cont'd from Pg. 13

MACHINE SHOP "LIBRARY"

Technical journals and reading table provide Gulf Research machine shop workers with a "library" which attracts considerable use. Left to right, machinists Edmund Weick, Kurt Nestel, Ralph Strohm and William Jenkins catch up with the newest wrinkles of their trade during lunch hour lull.

POWERFUL, MULTI-PURPOSE MAGNET HELPFUL IN LABORATORY, SHOP AND INFIRMARY

New G-S Magnetic Probe, made of super-magnetic alloy, is no larger than a fountain pen. Point of magnet is extended or retracted from streamlines polished bakelite case by turning end-knob. Strength of magnet can be controlled by amount of extension. Pocket clip is provided for safe, easy carrying.

The G-S Probe is particularly useful for removing steel or iron particles from areas where such foreign matter is harmful, such as the operating area of electrical instruments or delicate mechanisms. It will also conveniently remove sharp particles of steel, iron or nickel from storage bins and retrieve magnetic particles from holes and similar hard-to-reach places.

Assemblers and inspectors find the probe useful to test coat of surfaces for magnetic properties of the undermaterial.

Plant first aid stations use the G-S Probe to remove steel splinters from the eyes or skin of employees. Nurse or doctor can adjust strength of magnet for proper extraction to reduce pain or rupture of tissues. The Probe can be sterilized without harming magnet. General Scientific Equipment Co., Philadelphia 2, Pa.

MECHANIZED HAND TRUCK CUTS HANDLING COSTS, PREVENTS DAMAGE AND INJURY

The Tri-Truck, a new, mechanized, three-wheel hand truck, is announced by the Melooz Manufacturing Company. The Tri-Truck is a ruggedly built hard wood and steel general duty hand truck, incorporating a revolutionary telescoping support which adjusts and locks instantly to the correct balance position for any type and weight of load, even with the load on the truck. The Tri-Truck itself balances and supports the load, so that inexperienced, older, or lighter men can do safe, efficient hand trucking work. The Tri-Truck provides leverage which more than doubles the trucker's strength for easy loading, gives safe, sure control for unloading, and makes wheeling the load almost completely effortless. The Tri-Truck keeps the load balanced, even on rough, wet, or slippery surfaces, or if it strikes a floor obstruction, or if a collision occurs with another hand truck. A major cause of personnel injury and costly materials damage is thus virtually eliminated.

Once the Tri-Truck, is loaded, it is set for use as an easel, on the weighing platform, for movement in elevators, without the need for further loading and unloading. Time-consuming rehandling of merchandise, and lost motion are dispensed with. Melooz Manufacturing Co., 4730 Avalon Blvd., Los Angeles 11, Calif.

(Continued from page 11)

very close agreement with the corresponding curve values for groups of four thru ten machines, for both uniform and non-uniform servicing requirements. In no case did the actual interference resulting from a test differ from the corresponding curve value by more than 3%; the average difference was .86%. The actual average interference per machine for all tests involving four thru ten machines was 12.0% and the average interference per machine for the conditions tested, determined through the use of the interference curves, was 12.4%. There were significant differences between the actual interference values and mathematically determined interference values for groups of two and three machines. For this reason, the curves for these limited assignments are not included in the accompanying group of interference curves. The curves of assignments involving ten to one hundred machines have been tested for cone winding and weaving operations in several textile plants in the United States and Canada, and are reported to be reliable. On the basis of the test results and reports from industry, the accompanying interference curves are recommended for general use in determining average interference idleness per machine for assignments involving one operator, in which the running cycles of the machines cannot be coordinated.

A typical experiment under way on the machine-interference computer.

The application of the interference curves can best be illustrated by solving a problem. Assume one operator is to be given the following assignment:

Product	No. Machines	*%S
A	3	14%
B	3	20%
C	4	8%
	10	

*See previous definition of S and %S.

It is desired to determine the average percentage of machine interference idleness per machine when the operator averages 125% productive effort when tending the ten machines.

The total percentage normal work load for this assignment is 3 x 14% + 3 x 20% + 4 x 8% or 134%. The average %S per machine is 134%/10 or 13.4%. If the operator exerts 125% productive effort in servicing the machines, however, the $\%S_E$ becomes (13.4%/1.25)/(12.4%/1.25 + 86.6%) or 11.0%. The average percentage of overall time each of the machines will be nonproductive due to machine interference can be determined from the accompanying interference curves.

1. Locate 10 machines on the left vertical "Number of Machines Tended by One Operator" scale.
2. Project horizontally to the 11% "Ave.% Servicing Time Per Machine" curve.
3. At the point of intersection, drop vertically to the "Ave.% Interference Per Machine" scale; the answer for the conditions of this problem is 14% average interference per machine for each of the ten machines.

From the foregoing it is apparent that equitable wage incentive payment for products manufactured in various combinations in multiple requires an accurate, practical means of making allowance for machine interference for individual assignments. A plan for handling this problem will there for be presented in a future issue of the Journal.

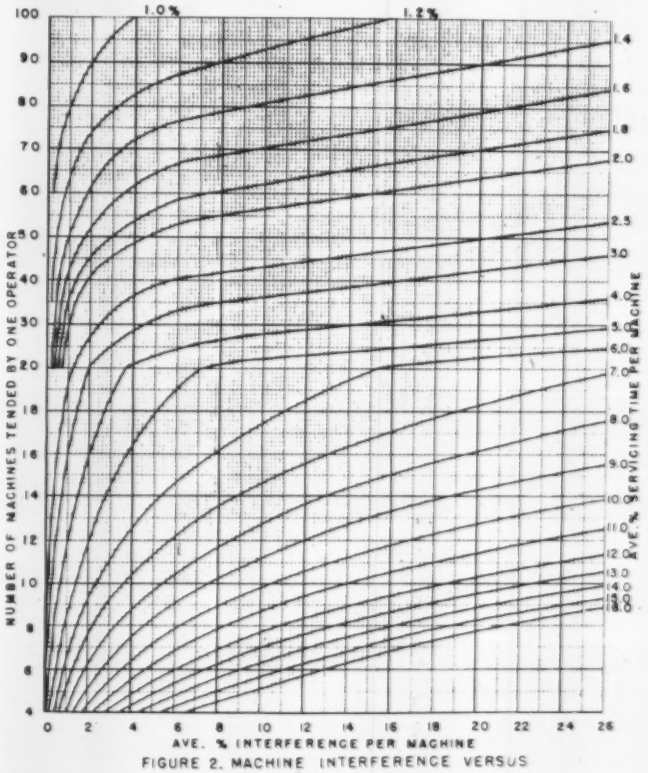

FIGURE 2. MACHINE INTERFERENCE VERSUS SERVICING TIME FOR GROUPS OF 4 TO 100 MACHINES

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(Continued from Page 2)

NATIONAL CONVENTION

Everyone connected with our very young organization is eager to have the first national convention. Some of our problems will be helped toward solutions as soon as this happens. It was postponed because doing so will permit a larger membership to attend. Plans are now being developed and each chapter should think about the election of a delegate. Suggestions from the chapters will be most welcome.

CHAPTER NEWS

All chapter secretaries, both student and senior, are urged to follow the practice of sending letters to the national headquarters frequently reporting the activities of their groups.

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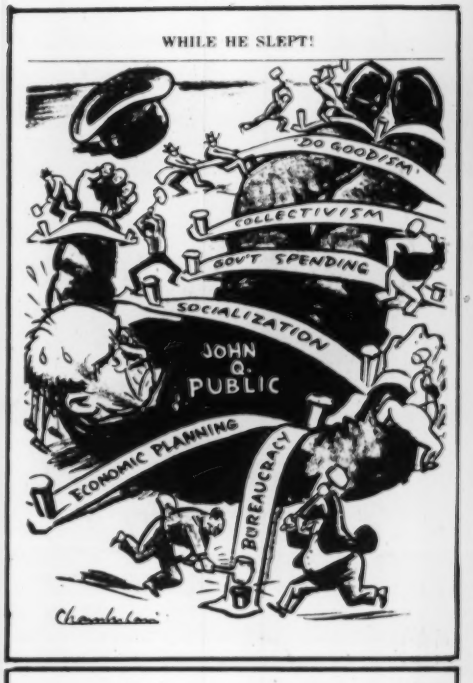

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THE COVER

The world's most powerful industrial truck, capable of handling loads up to 110,000 pounds, is shown lifting highway trailer with four Oldsmobiles at factory of its manufacturer, Automatic Transportation Co.

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EDITOR'S PAGE

Let Not Thy Right Hand—

THE MAN GOT on his horse and rode off in all directions. How, pray, can we have improved efficiency in government, as advocated in the Hoover Report, and at the same time pass restrictive legislation that would eliminate and prohibit all efforts by supervisors or other officers or agents of government from increasing efficiency or even maintaining what little semblance is there already.

Efforts are being made by certain members of Congress to extend the "no stop-watch" clause used on Navy appropriation bills since 1916 to all government contracts. (See Congressional Record August 26, 1949, pp 12543-8.) In times of National emergency all our people are either directly or indirectly government workers. At the same time we are called upon for high efficiency in order to conserve our manpower and protect our National economy. Manpower shortage became acute in 1944. Increasing costs are now threatening our whole economy and the passage of a bill or an amendment to eliminate time study and incentives could be disastrous at this time.

Time Study and all its relatives in the field of industrial engineering have played a large part in giving this country world leadership in the fields of production and distribution. We can not afford to jeopardize this position. National security demands increased efficiency in the United States as our only offset against vastly greater manpower in other countries.

Attention is invited to the following quotes from the August 26, 1949 Congressional Record — Senate: pp 12545, Senator Flanders "Mr. President, I raise objection to the whole committee amendment. The first arrival on the stage of Federal legislation of this anti-stop watch provision was a good generation ago in its application to Government work in navy yards. That was in a period when time study was a new thing, and organized labor was very much opposed to it. Since that time, time study work has become the main basis of the increase in efficiency in the manufacturing and distributing business on which the ultimate raising of the standard of living of the working men depends. Time study has been the means by which the standard of living in this country has been raised. The worker does not work longer hours, he works shorter hours as a result of it. The worker does not work harder, he works easier, because the means for handling materials and handling his work and the manipulation of his machine is made easier year by year than it was before. The worker is dependent on time study for the improvement in his material conditions. There is absolutely no excuse now for ruling it out of Government work anywhere at any time. It is the workmen's friend and not his enemy.

"The situation in the plant in Vermont with which I was connected until I came to the Senate is interesting. There, in spite of being frowned upon by the national organization to which the union belongs, the union in that plant insisted on writing into its contract with the company incentive pay based on time study. The insistence came from the men, and not from the company, and that was because they were satisfied that they could properly earn more wages by that means than the company could afford to pay them otherwise.

"Mr. President, in my view the whole of section 630 is not in the public interest, and I hope the Members of the Senate will vote against it."

pp 12545, Senator Magnuson, "Mr. President, for the purpose of the RECORD I wish to make a statement concerning the pending amendment. The Senate is very familiar with the situation involved, because every year — I know every year I have been in the House or the Senate — this provision has been added to appropriation bills, particularly in relation to the Naval Establishment. Every year an attempt is made to knock out the provision. So far, in many Congresses extending back as far as 1916, such attempts have been unsuccessful.

"There is a great deal of merit in this provision. The Navy has worked satisfactorily with it for many years. There has long been a prohibition against applying the so-called stop-watch technique to Navy workmen. I know of no statement on the part of any branch of the Military Establishment — either the Army, the Navy, or the Air Force — objecting to this provision. I do not see any reason why we should change it now."

pp 12545, Senator Taft, "Mr. President, I merely wish to say that if it has been necessary to put this provision into the appropriation bills for 16 years, the time has come to stop it. If this provision is to be made applicable to present-day conditions, then it seems to me it should be done by independent legislative enactment; it should not come up every year on an appropriation bill, without consideration, without opportunity for the hearings which should be given to straight legislation.

"So it seems to me the motion to suspend the rule should be rejected."

The amendment was defeated last year by a parlimentary move — it probably will be brought up again this year. It's your move.

— F. F. Groseclose

The Time Study Man

With watch in hand at the stroke of eight
He starts on his way to investigate
What new and innocent soul may be
First to be placed in misery.

He saunters up with a knowing look,
Asks questions enough to fill a book,
Then says, "Why is it done that way?"
"That's not required, you'll waste all day."

He picks up parts and walks away
Muttering low as if to say,
"Why can't that fellow use his head?"
"It should be done this way instead."

Over to inspection he goes
To spread his tale of many woes,
And after they sign their lives away,
He's sure he's saved the proverbial day.

And so from figures he didn't get
He sets a rate that can't be met.
He gloats with greater interest yet
When operators start to sweat.

When squawk is raised he'll sometimes come,
But all he'll say is, "Pull out, chum."
And when you're tired enough to scream
He'll say, "Get going, ride the beam."

This verse describes the common view
Of what the Time Study Man is true,
He has a sterner task to do,
But he is always square with you.

This "Dragon Man" is thought to be
A menace to humanity.
But down inside he's bound to be
The same old stuff as you and me.

He eats his Wheaties, sips his tea
Loses his hat and twirls his key
So when this friendless guy you see
Think, "He's doing a job the same as we."

J. S. Wells

Our Large Production

Because of our tremendous production, we own half of the world's electric power, half of the radios, more than half of all the telephones, produce more steel, own 60 per cent of the world's insurance policies and 85 per cent of its automobiles. — *Exchange.*

Organization Control

Introduction

If we make comparison between the work of the butcher, the baker, and the candlestick maker, the differences in technique are obvious and large. But if we compare the bases on which these three activities, as business entities, are built the differences become small indeed.

Design, production, financing and sales being the commonly accepted major functions involved in Manufacturing, modifications only in kind and relative importance occur in the major functions depending upon the nature of the industry. Underlying the activities of every Company however, there is found organization and in this respect they have a common progenitor or basis.

Definition

After vainly searching for a concise definition or organization, the following seems most adequate in expressing the thought: "Organization is the framework within which individuals collaborate in the attainment of a common objective."

Production Handbook states that "organization includes; (1) the persons who man the company, (2) the respective places which they occupy, (3) the range of authority and responsibility which they individually exercise, (4) the framework of relations through one another, and (5) the mechanisms through which they operate and coordinate their activities in the enterprise."

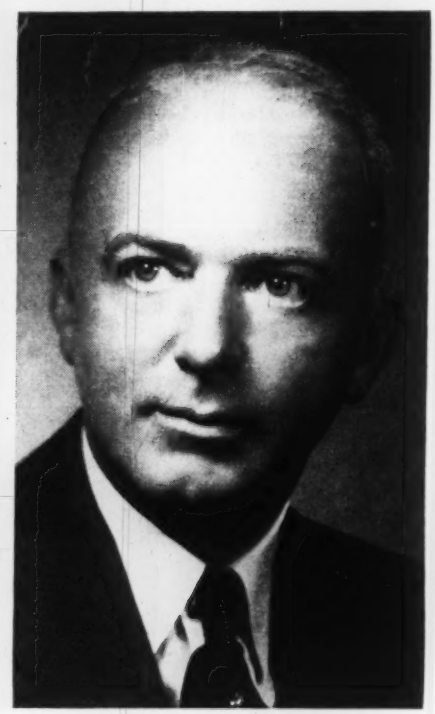
Control of Organization— Essential:

That a sound plan of organization is essential to the success of a business enterprise, needs no comment and it is equally clear that each player on the business team must thoroughly understand his position and what it involves, before he can exert his entire game-winning energies.

It would be needlessly time-consuming to talk to this group about the various kinds of organization. You are familiar with staff and line, the meaning of functions, duties, responsibility, authority, and a logical grouping of functions to achieve the desired result. Let us, therefore, first consider the present status of U. S. companies in this respect and later consider the means by which top management creates and perpetuates a sound organization.

Proper Control Generally Lacking:

Holden, Fish and Smith's study of organization control was based on the experience of 31 nationally known industrial companies. In total, these companies have assets of $8 billion and, normally, they employ 850,000 workers. Industries represented are: Building materials, chemicals, food products, machinery, non-ferrous metals, petroleum products, rubber, and steel fabricating.



DON SUNDERLIN
MANAGING PARTNER
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It is significant that the authors of "Top Management Organization and Control" found in the course of their study that only a few companies had given the attention to the subject of organization control which they felt the subject warranted. If some of the *best known* companies in the country have been lax in this respect, what must the rest be like? It seems plain that the door to improvement in this field is wide open and size is not a limiting factor. Sound organization is necessary whether the company is the size of General Motors, Thompson Products or Accurate Parts.

Ideal Seldom Reached:

The adoption of the "best" organization plan is something rarely, if ever, seen, for the reason that conditions and personnel are constantly changing. The optimal plan, then, is that which is practicable for the present and the foreseeable future. To maintain its effectiveness requires periodic study to keep it in line with requirements, and regular review to see that it is being properly followed.

Control Functions:

Top management obtains and maintains control over organization planning by a series of procedures and instruments. Time limitations prevent describing all of them, so only the most important have been selected for discussion this evening. The complete ist pertinent to control only includes:

1. Organization Charts.
2. Job Specifications.
3. Procedures.
4. Organization Manual.
5. Initiation and Approval of Organization Changes.
6. Periodic Review of Organization Practice.
7. Training in Organization Principles.

Control Procedure:

Comprehensive organization planning is done by taking the following steps:

1. Keeping up to date with the developments in industrial organization throughout the industry.
2. Testing the soundness of every phase of the existing organization plan from a wholly objective viewpoint. This requires analysis of organization, functions, responsibilities and relationships.
3. Charting the ultimate plan which will most effectively meet the basic requirements of the individual business.
4. Appraising the capabilities of the key personnel in terms of specific jobs.
5. Charting the intermediate plan which represents the maximum distance toward which the ultimate plan can be presently approached.
6. Scheduling the changes to be made with a view toward the least possible disturbance to morale and the effectiveness of the existing organization.
7. Selling the changes to the persons affected.
8. Writing the specifications for each key job, defining and clarifying functions, responsibilities, objectives, limits of authority, and relationships with other parts of the organization.
9. Keeping the organization plan up to date.

This procedure usually develops many opportunities for strengthening and improving the existing organization structure. Some of the common faults we have found in the course of our studies are:

Too many or too few subordinates reporting to an executive.

Overlapping of responsibility and authority.

Improperly channeled executive action.

Incomplete utilization of individual talents.

Unbalance due to underemphasis or overemphasis of basic functions.

Lack of essential checks and balances.

Lack of adequate criteria for measuring executive performance.

Organization Chart:

The foundation of control over organization planning is an organization chart giving a graphic illustration of the structure. The very act of preparing this kind of chart frequently brings to light weaknesses which otherwise would be overlooked or accepted as a necessary evil.

Generally speaking, the process of building an organization structure is one of studying jobs and people *separately* and then matching them to best advantage toward the objectives of payroll economy and smooth teamwork. We start at the top by preparing a written description of each significant job as it exists, and then we reduce it into its components of (1) Responsibility for various duties, (2) Authority over other operations and (3) Its relation to other jobs in the organization. With this information, obtained on a uniform basis from the individuals involved, it is possible to chart the essentials of the present organization which discloses opportunities for improvement in the grouping of functions, arrangement of work, clarification of responsibility and authority and to adopt more accurate job titles.

The principles used in arranging and grouping duties are, separation of line and staff functions, the fundamentals of division of labor, specialization and the provision of proper checks and balances throughout the organization. At this stage it is assumed that qualified people either are on hand or will be found to meet the specifications indicated by the resulting job descriptions. The quality of the eventual organization depends to a great extent on the degree of objectivity applied to this phase of the work.

Since some managements fear that publicizing their organization chart will cause dissension among certain executive personnel, the chart is often treated as a top-drawer secret. To be really effective, all staff and supervisory personnel should have a copy of the chart together with a complete explanation, so that there is no room for the slightest misunderstanding.

Job Specifications:

After the organization structure has been planned, the next step is to define the essential requirements of each committee and key job. This establishes the conditions which, when fulfilled, will result in the maximum contribution by each person to the success of the enterprise. Job specifications and requirements serve the following important purposes:

1. They give each key man a clear conception of his job and its relationship to the organization as a whole. Spelling out just what is expected helps him to work harmoniously with the other members of the team and to concentrate on the attainment of specific objectives.
2. They materially help new appointees by informing them of the requirements of their job.
3. They provide a sound and logical basis for the periodic appraisal and rating of individual competence, in terms of performance on the job.
4. They also serve as an ideal basis for salary evaluation which is an essential procedure even though not directly related to the subject of organization control.

In defining each job and writing its specifications to fulfill these purposes, it is desirable to cover:

Scope — indicating the general extent of jurisdiction over functions and personnel.

General objectives and responsibilities. The responsibilities are supplemented by specific duties.

Relationship to superior and to other units of the organization.

Measurement of incumbent's effectiveness.

Limits of authority.

To those who have had no experience with organization manuals, such an analysis might appear rather formidable. Frankly, it is not a job for the office boy, but the time spent in formulating the plan of organization will be amply repaid through making easier and more effective, the handling of the many matters and problems with which each key man is concerned.

Developing Job Specifications:

The first step in developing such job specifications is, normally, to determine the present practice as to functions, objectives, relationships, and limits of authority for each agency, individual, and key job. From this information the most logical specifications and relationship are worked out to permit each executive to function most advantageously.

Organization Manual:

To facilitate control over the organization aspects of management, to insure that each person concerned has a clear conception of his proper part in the overall picture, and materially to assist in the administration of the plan as sins of omission or commission are encountered, the plan is packaged in the form of a Manual. The ultimate plan of organization, including organization structure and specifications for all key jobs, with changes to be made as opportunity permits, is confidential. Properly indexed, the Manual for *general distribution* includes:

1. A foreword, signed by the chief executive.
   (a) Explaining the purpose of the manual.
   (b) Definitions of terms used.
   (c) Need for cooperation between individuals even though the main channels of their activities have been delimited.
   (d) Date new plan is to become effective.
   (e) Policy regarding enforcement.
2. A set of *organization charts* including in addition to one for the company as a whole, charts for each major division — representing the current, approved organization plan.
3. Approved job specifications describing the functions, responsibilities, objectives, limits of authority, measurement of performance and relationships of each person or organization unit, including general management, divisional management, committees, executives, and key jobs.

The importance of clear and concise expression in the preparation of such a manual cannot be overemphasized.

A comprehensive organization manual is very effective in (a) achieving and maintaining a sound plan of organization; (b) insuring that all concerned have a proper understanding of the general plan and their individual parts and relationships therein; (c) facilitating the study of organization problems; and (d) evaluating the effectiveness of the individual in terms of job performance.

Without careful consideration one might conclude that this grooving of effort stifles initiative but on the contrary a correctly written manual, reflecting a sound structure, actually promotes utilization of this important asset and limits it only to the extent that improperly directed, it would be harmful to the enterprise.

Building the Organization:

Since men are individuals and not standardized automatons, the second step usually is to modify the text book plan of organization so that unusual skills possessed by certain individuals may be utilized. It, of course, is necessary to remain within proper functional limits when this is done or otherwise a new structural weakness will develop.

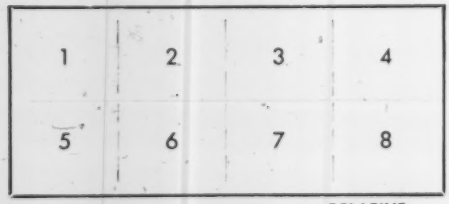
Building an organization is completed by placing the available people in the re-

vised job arrangement as indicated by their qualifications and previously demonstrated abilities. The outside consultant and the Top Management work together on this, making every effort to accommodate present employes and usually adjusting the lineup of duties to take advantage of desirable people who have unusual combinations of skill or knowledge. Where no properly qualified person is available or in cases where the accommodation of a peculiarly qualified man would seriously injure organization efficiency, a program of replacement is worked out in conjunction with Top Management. As frequently happens when an organization structure is overhauled, there may be a surplus of personnel which permits retaining the better ones and often giving them more stimulating jobs.

Rebuilding:

After the organization structure has been constructed and staffed, there remains the never ending task of improvement. You observed from previous remarks that the designing was done from the top down. Building, or perhaps more accurately, rebuilding is done from the bottom up.

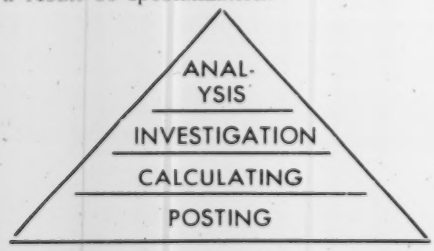
Since it is customary to pay for the highest of the various skills required, there is opportunity for economy through deskilling. To be specific, assume the work of a group of clerks to be; posting, calculating, investigating, and analyzing. Graphically this may be represented by a series of squares each of which corresponds to a person.



OPERATION	RELATIVE WORTH
Post	1.5
Calculations	2.5
Investigation	3.2
Analysis	4.0

The numbers shown opposite the functions were chosen according to an arbitrary scale to indicate relative importance. Call them cents per hour, if you like.

Rearrangement of the work in pyramidal form results in a figure of lesser area, indicating not only an overall gain, but further and substantial economy as a result of specialization.



Thus organization control which includes constant rebuilding is a never ending job in an enterprise of any size. In the Steel Corporation it is the full time assignment of a number of persons.

SUMMARY

This brief discussion has been intended to point out that control over organization is one of the most vital, though largely unrecognized, needs of management. Furthermore, the need is more or less continuous depending upon the rate of change through personnel, growth, policy changes, etc., of the individual company. Its control, therefore, must be the specific assignment of some individual or agency. The nature of the problem and its manifold aspects require that the responsible person or agency report to the chief executive.

The finest organization structure implemented by properly qualified individuals becomes effective only when properly directed. It is top management's function to direct the organization so that:

(a) The function for which each group is responsible is carried out.

(b) Proper coordination of the various groups is obtained. Too much administrative attention to one activity at the expense of another prevents unified functioning of the whole.

(c) Each individual devotes all his efforts to the work assigned to him and does not become involved in the work assigned to others.

(d) A co-operative spirit and an attitude of loyalty is developed and maintained.

With proper organization, the success of the operation is not assured, of course, but a long step forward has been taken when control has been obtained.

(The foregoing address was delivered before the Cleveland Chapter of the Society for the Advancement of Management by D. H. Sunderlin, managing partner of the Sunderlin Organization, Management Engineers, Cleveland.)

Painted Machines Safer to Operate

To reduce the number of accidents caused by eye fatigue and labor turnover due to employe boredom, scores of manufacturers are using barrels of varicolored paints in the interior of their plants. One plant found that by painting machines green, walls yellow, and by smearing dashes of orange at strategic points, it reduced by 38% the number of days lost through accidents. Absenteeism fell from 5% to 2%, and labor turnover from 4.5% to 4%. Another company found that painting machines increased production 10 to 12%, and reduced accident rates from $1.21 to 18 cents per man over comparable periods.

Notes From The National Secretary

National Convention

Plans for the 1st annual National Convention are progressing slowly but surely. Proceeding on its position as the oldest chapter of the Institute and its location in a city that is chosen each year as the scene of hundreds of National Conventions, the Columbus Chapter has made the following bid which will be considered at the next meeting of the Board of Trustees:

"Acting on a motion passed at the Columbus Chapter Executive Committee meeting of Jan. 12, 1950, I wish to extend the following invitation to The National Executive Committee:

" 'That the Columbus Chapter desires and will be pleased to act as host for the first National Convention, assuming all the necessary responsibility that such action would entail.'

"We would be most gratified to have our offer accepted by the National Organization and will appreciate a reply giving a decision at your earliest convenience."

Regional Vice Presidents

In an area where there are no senior chapters in operation the National Board of Trustees has the responsibility of filling the position of regional vice presidents. The Board is very happy to announce that Prof. Ralph M. Barnes, formerly of Iowa State University, Iowa City, and now professor of engineering and production management at the University of California, Los Angeles, has accepted to permit his election as vice president to the Western United States. All the industrial engineers in the Western States are urged to contact Prof. Barnes with reference to any questions that they may have concerning the AIIE.

St. Louis Chapter

The recently graduated president of the Washington University Student Chapter, Melvin Bierman, whose address is 5830A Westminster Pl., St. Louis 12, Mo., has been contacting AI's in St. Louis for the purpose of forming a St. Louis Chapter. This is of course a very logical development, and all members and prospective members in the St. Louis area are strongly urged to get in touch with Mr. Bierman.

What Industry Expects of a Young Engineer

JOHN B. WOODWARD, JR.
President and General Manager, Newport News Shipbuilding & Dry Dock Co.

This paper was presented at the meeting of the V. P. I. Association for the Advancement of Engineering, Blacksburg, Va., Jan. 14, 1950.

INDUSTRY, IF IT is to survive in the face of ever changing conditions, must maintain design, research, supervisory and executive forces — forces adequate in numbers and adequate in ability to meet any reasonable demand within its particular line of activity. An optimum staff once obtained does not, unfortunately, remain static but is constantly changing as personnel advancements and losses, together with varying load demands, make replacements or additions necessary. It is for these replacements and additions that industry looks to the colleges and universities — and primarily to those which offer engineering training. When you realize that among the newcomers of today will be found the executives of tomorrow, it is easy to understand industry's vital interest in the young engineer and his qualifications. It is equally important, if these qualifications are to be found in the young engineer, that he be made familiar with them during his student years.

It is the purpose of this paper to present and to discuss briefly the principal qualifications for which industry looks. Requirements vary of course in different lines of enginering activity, and many of the qualifications which would appear most desirable for one type of work will not necessarily apply so directly to another. The qualifications expected of a designer will differ from those of a sales engineer, and the requirements for the position of a shop supervisor would not be applicable to research work. There are, however, certain basic qualifications for which every employer looks when considering an applicant for any type of engineering work.

These basic qualifications can be listed under four headings:

1. Good character
2. Satisfactory personality
3. Sufficient training
4. Willingness to work

Possession of good character is so fundamental in any employment, manual labor and jobs of a low order of skill and responsibility perhaps excepted, that discussion of this qualification hardly seems necessary. Obviously no company would employ a young engineer graduate known to be lacking in integrity, loyalty, or conformity to generally accepted moral codes.

The other basic qualifications are also admittedly general in scope; they overlap to some extent and will vary widely in different individuals. A deficiency in one of these latter basic qualifications may often be offset by a more than average measure in another.

I have known men with unattractive personalities or with limited ability who have made good, largely as a result of an over-development of some other faculty, but the market for such individuals is limited. On the other hand, I have never known a successful man who was really allergic to work.

The qualifying words "satisfactory" in connection with personality and "sufficient" in connection with training are not superlatives and are used advisedly. Industry does not limit its employment to those who have demonstrated exceptional athletic or scholastic ability. The desirable engineering graduate has been described as being a "well-rounded-out individual with a good personality, qualified by education and experience to make a good engineer." Let us now consider these qualifications in somewhat more detail.

Personality for our purposes may be defined as the traits, habits, and attitudes which collectively constitute a person. In the young engineer, the employer's interviewer, whether himself an engineer or a trained personnel man, is most likely to give weight to the applicant's *accuracy and thoroughness, ability to get along with others, imagination and initiative.*

The engineering executive seldom finds time to investigate and check in detail the various phases of the many problems which pass over his desk. He must rely largely on the reports and findings of his assistants to guide him in reaching a decision. A careless, inaccurate, or incomplete report may have serious consequences in loss of time and materials, or even in the jeopardizing of human lives. We have difficulty with most young enginers in training them to finish a job, finish it 100 per cent, wrap it up, tie it up and deliver it. Most of them have a tendency to bog down along about the third quarter. The student who makes 90 or 95 per cent on an examination is rated quite highly, but the young engineer who brings back 95 per cent of the information needed either has another trip ahead of him or someone else has to complete the job.

Incidentally, industry is much more interested in the man who will say, "I do not know but I will find out," than in the man who will take a chance and report a satisfactory condition when he is not fully informed. There is no place in the engineering world for the careless, inaccurate individual.

Some years ago an incident came to my attention. A service engineer representing a company which had furnished a piece of machinery for a certain development, turned in to his company a glowing report of the acceptance test. He was correct — the test was most satisfactory and the piece of machinery was accepted, but he failed to state that he had overslept that particular morning, had missed the train, and was not personally present when the machine was operated. The two companies involved later learned the facts and had a hearty laugh over the matter. But the next time a new machine was tested another service engineer was on the job.

Next to accuracy and thoroughness I would place the faculty of getting along with other people. This faculty is not necessarily born in a man. It can be and is often cultivated. It is based primarily on a willingness to see and to take an intelligent interest in the other fellow's side of the story. When the man in the shop calls on the phone to know "why in hell the drawing room hasn't put a certain dimension on a drawing," that man is in trouble, or at least he thinks he is. How much better to look at the situation from his viewpoint and simply tell him where to find the elusive dimension than to suggest that he "get the lead out of his pants and the grease off of his glasses and look for it." Inability to get along with people is not too common but it breaks out in unexpected and embarrassing places. How often have we wished to send an engineer out on a trip to represent the company and hesitated to do so because, in spite of his knowledge of the subject, he does not get along with people. Such a situation is not uncommon and is most unfortunate, particularly as the man with a little effort can overcome this most serious handicap.

One of our young engineers at one time became very much disturbed on account of the editing which his letter memoranda were receiving after they had left his hands and before being forwarded as finished letters. One day while considering the matter the disturbing thought came to him, "Would I be willing to sign my own name to the letters which I am daily preparing for the boss to sign?" His answer was "No." The next letter memorandum was carefully prepared on the basis that the writer

would be willing to sign it were he in the boss's shoes. The boss signed it without change and the trouble was over.

Imagination and initiative are also important qualifications. There is always a need for "wheel horses," men who are reliable workers and will do as and if they are directed, but the supervisors, the superintendents, and the executives are drawn from the ranks of those who can think and plan ahead. One of the first duties of an executive is to train his assistants to carry on in his absence. Industry wants men who have the imagination and initiative, and who can and will accept the responsibility which goes with such training.

Before leaving the subject of personality I would like to mention the following incident. A few years ago we received a letter from a professor at one of our larger engineering universities; he asked, in connection with the placement of one of his students, if we could use a man with a split lip. We replied that we were not particularly interested in the man's lip but asked in return what he had in his head. The reply was satisfactory and we employed the young man. He turned out to have an excellent personality and plenty of ability. The slight impediment in his speech has not hindered him from making good in a big way.

With respect to training, the amount and particularly the type of training required by the young engineer vary considerably with the kind of work which he will be expected to do. There are, however, certain basic qualifications which industry expects to find in the young engineer.

First, he should have a good foundation in the fundamental sciences, physics, chemistry, mathematics, etc. This does not mean that he will be expected to handle the more difficult engineering problems without an opportunity for further research and investigation. He should, however, have a sufficient understanding of the scope of the engineering world into which he is entering to be able to listen intelligently and to know where and how to look for the answer to the problem in hand. In the world of industry the information necessary to handle a particular problem is not handed out in exact amounts on a silver platter; it has to be sought and evaluated.

A professor at one of our engineering schools makes a regular practice during examinations in applied mathematics of presenting problems in which the information supplied is too little, too much, or incorrect. In explanation of this practice he advises that anyone should be able to work a problem when exactly the right amount of data, no more and no less, is at hand, but he wants to know if his students are sufficiently familiar with the subject to find out what is wrong and to ask for the correct information. In other words, do they know how much they do not know? Industry has a great deal more confidence in the young engineer who knows how to find the answer than in the one who feels that he does not have to look for it.

The young engineer who plans a future in the strictly technical or research field should be well versed in advanced mathematics and in those branches of applied mathematics which are used in the particular field he has in mind. On the other hand, design and construction work call for a working knowledge of ordinary mathematics, but there is usually less need for calculus and other branches of higher and applied mathematics.

The average college graduate in engineering seems to lean towards research work, with supervisory work or sales as a second choice, and displays a decided aversion to any form of drafting. He would do well to remember that, with the exception of some possible previous experience, his value at the start is chiefly potential. Engineering in all of its phases involves design, and the two best places to learn practical design are the drawing rooms and the shops. Few graduates wish, or are even able, to spend time in a shop learning the purpose and limitations of the various machine tools. The drafting room offers a special opportunity not only from the purely design viewpoint but also from its contact with the shops. There, the young engineer not only learns to put his ideas on paper but also has the opportunity of seeing them develop through the pattern and machine shop stages to the finished product.

An applicant's previous experience is always of interest to the employer, particularly if it has been obtained in the same line of work he is seeking to enter or in a drawing room or shop. An excellent practice which has been followed by many students is that of obtaining employment during the summer vacations in a drawing room or machine shop. A grasp of drawing room and shop practice can be obtained in this way in a short time which will be of real value to the student both during his college years and after graduating.

The third requirement or qualification, willingness to work, requires little explanation. The average young engineer is not physically lazy, but when it comes to mental activity — the willingness to think things out to a conclusion — there is often room for improvement. I have in mind a situation which arose not too long ago where a man was needed to fill a supervisory position. We had the man, with the necessary experience and ability. We led him up to the trough and we nearly drowned him, but we couldn't make him drink. He had, probably unconsciously, placed a limit on the amount of thinking he was willing to do, and when we loaded him up beyond that rather moderate limit he would simply stay home for a couple of days. He is still occupying a minor position.

In recent years a number of surveys have been made by various authoritative groups to determine just what are the bases on which engineering employees are selected. It is most interesting to note that personality heads the list, with ability to get along with others close to the top. These surveys have also indicated certain deficiencies which employers find in the young engineer. Some of the more frequently reported are:

- Inarticulateness in expression and writing
- Lack of drafting and design experience
- Lack of business knowledge
- Insufficient knowledge of shop practice
- Insufficient knowledge of materials
- Lack of interest in civic affairs

There is another extremely important qualification which I have not listed, as it is quite difficult to detect the undeveloped faculty in the applicant for employment. It often becomes apparent quite early in the career of the young engineer, and still more often is poorly developed in men of considerable experience. I am referring to analytical ability. Crudely expressed it is the ability to separate the big items from the little ones. In other words, it is the ability to properly evaluate the different factors or components which enter into a particular problem so that proper emphasis can be placed where it is needed. We often hear of a man being "swamped with details" or "that he cannot see the woods for the trees." It is all the same failing, and it results in time and energy being wasted on non-essential items at the expense of the important ones. One mark of a successful executive is his almost uncanny ability to put his finger on the important item, or on the sore spot, to the complete exclusion of the multitude of obscuring details.

Ambitious young engineers at times are apt to worry for fear that their particular abilities are not being recognized. I can assure them, from observation and experience in working with professional men over a considerable period of years, that the minute a particular head sticks up above the rest of the group the boss will know it and will do something about it at the first opportunity.

I would like to leave with you this thought — engineers are made and not born and industry is always looking for the men who have the "makings." There is an old saying to the effect that there

is always room at the top. That is just as true today as it always has been, but it is amazing and disturbing how difficult it is to find a really qualified man when a position of authority and responsibility unexpectedly develops.

There is one concluding comment which I would like to make. Those of you who may enter Government service are likely to be confronted with some form of "loyalty test" to make sure that you would not be a potentially subversive or destructive member of the group. I know of no such test applied to young engineers who seek connections with industry, but it would seem wise for such young men before starting their careers to acquaint themselves with the American system of private enterprise. The fact that you have an understanding of this system might weigh heavily in your favor with your prospective employer. I will not attempt to tell you where knowledge of this kind can be found but the sources are numerous and the honest seeker can easily find the truth.

I should like also to pass on to you this quotation from an article by Charles E. Wilson, the President of the General Electric Company in the December 1949 number of the General Electric Review. Mr. Wilson makes this statement with respect to American industry:

"It is labor, it is management, it is research and engineering, it is investment, and it is sales. To some degree it is just about everybody you know — and not just a small, selfish, rich and aged group of Republicans.

"For every one of us who believes that what happens to America — and therefore to the world — must be a direct result of the efficiency and productiveness and leadership of our own competitive economy, the hard and constant fight consists of this day-by-day campaign to teach our people that industry is not a political party, that it is not a special interest, that it is not an antisocial force. Rather it is the organized striving of millions of our fellow citizens, the harnessing of their brainpower and their labor, the mustering of their needs and desires, the enrollment of their ambition and their accountability, to the end that they will be better fed, better housed, better secured against disaster, better informed, and inspired by a true respect for their own powers and their own dignity."

Who Wants to Dig With a Spoon?

Two workingmen watched a steam-shovel handling great chunks of earth at each bite.

"If it wasn't for that scoop, 500 of us might be working," said one.

"If it wasn't for our shovels, a million of us might be working with spoons," the other retorted. — *Exchange*

Students at Georgia Tech Open New Lounge

The student chapter of AIIE at Georgia Institute of Technology continues to be one of the most active on the campus.

During the first part of September the student lounge (pictured above) for the school of industrial engineering was opened. This well furnished lounge was made possible by the enthusiastic efforts of a student AIIE committee headed by Jeff Macon. Donations by industrial engineering students, gifts from local business organizations and from the institute made up the major part of the fund. Several of the student's wives gave their time to make drapes. Col. Frank Groseclose, Director of the School of Industrial Engineering donated a large radio to complete the furnishings.

Chapters Stage Panel Meetings

J. L. SOUTHERN
Secretary, Columbus, O., Chapter AIIE

As a special project of the current season, in addition to the regularly planned program, the Columbus Chapter of AIIE has undertaken participation in a series of educational panel discussion meetings in conjunction with the local chapters of The Society for Advancement of Management (SAM), and American Society for Quality Control (ASQC); with each group sponsoring one of the three planned meetings.

Through these joint sessions it is hoped to create added interest of the membership and also to present a more varied, beneficial and comprehensive program. At the present writing two of these meetings have been held with the third scheduled for Feb. 2, 1950.

The first program, entitled "Cost Reduction Through Scientific Management," sponsored by SAM was held Nov. 7, 1949. The panel included F. R. Coumbe, Plant Manager, Owens-Corning Fiberglas Corp., Newark; J. F. Cunningham, Jr., Works Manager, International Derrick & Equip. Co., Columbus; Ralph C. Davis, Professor Industrial Management, Ohio State University; E. D. Walker, Superintendent, Ceramic Division, Lustron Corp., Columbus; W. L. Werner, Cost Manager, The Anchor Hocking Glass Corp., Lancaster, and W. M. Keller, Production Manager, Owens-Corning Fiberglas Corp., Newark, who acted as moderator.

The second program, entitled "A Tailor-Made Materials Handling Program," sponsored by AIIE was held Dec. 1, 1949. The panel included John Shea, General Superintendent of F & R Lazarus Co., Columbus; Richard M. Hardin, Plant Industrial Engineer for the Columbus Plant of the Omar Baking Co.; Dwight D. Gardner, Vice President of Commercial Motor Freight, Inc., Columbus, and National President of AIIE; John W. Brantner, Industrial Engineer with the Jeffrey Mf'g. Co., Columbus, and Prof. W. G. Stanton, Head of the Management Division of The Industrial Engineering Department at Ohio State University who acted as moderator.

The third program of the series will be entitled "Quality Control Methods Versus Regular Inspection Methods" and will be sponsored by ASQC. Their complete program and speakers' panel have not yet been announced.

Engineering Office Operations

ALEXANDER M. GOW, E.M.

QUITE OFTEN WE HEAR and are inclined to believe that the frontiers of opportunity faded with the last generation: pioneering is past, the mines have all been prospected and industrial expansion has submerged the chances for individual enterprise, regimentation is unavoidable and we may aspire only to becoming cogs in the modern social machine! Such a defeatest attitude is incompatible with human instincts and with engineering principles; and while, of course, such a position is untenable, the prevalence of the belief makes any field of endeavor the more attractive which offers an opportunity for expressing the creative urge and for applying profitably those principles which were applied so successfully in the "good old days."

Such a field is to be found for the engineer in a branch of the profession which, popularly, is not thought of as being "engineering": the application of engineering principles and thinking to office management and white collar operations.

When waterpower is to be converted into electricity, when automobile bodies are to be fabricated from sheet metal, or when gears and levers are to be assembled into machinery, one without questioning accepts these as engineering problems. However, when the matter under consideration is the conversion of brain-power into procedure, the fabrication of sheet paper into documentation, or the assembly of people into white-collar production teams, one may not so readily recognize that the problems are fundamentally the same although the tools are different.

In its broadest sense a tool is any object which is used to facilitate an operation; and a human being, in many cases, is as much a tool as is a monkeywrench. The messenger boy, functionally, resembles a conveyor belt; an accountant, adding a column of figures in his head, is analogous to a calculator; and a draftsman often substitutes his own skill for that of a drafting machine. This does not mean that men should or may be considered as intermittent conveyors, as tapeless calculators, or merely as drafting machines. Economically, as well as morally, men are not chattels. They are more complicated, more versatile, and often more confusing than any inanimate device; but they are the chief tools, as well as the operators, of white-collar production enterprizes.

Good management consists of the proper procurement and efficient use of these human tools, while ever mindful of the fact that they are intelligent creatures of dignity and free will.

It is the purpose of this article to outline the problems and the more important phases of office management and white-collar operations, using the engineering approach and analogy.

ALEXANDER M. GOW

After more than 15 years in teaching and research experience following his graduation from the University of Minnesota in 1923, Mr. Gow switched over to Industrial Engineering. He started the procedures section of the Industrial Engineering Department of the North American Aviation Inc. of Kansas. He later became the staff assistant to the plant manager. At the end of the war he returned to U. S. Corps of Engineers and has worked on their problems of administration. He is author of several technical publications.

Top Management & Policy

Whether the establishment is a small grocery store, a metropolitan commercial establishment, or a government agency, it starts with a top management decision as to purpose and policy. This statement and its development are inane when applied to the simple case: "The owner of the grocery store must first of all determine that the prime mission of his enterprise is the merchandising of groceries!" However, when a Board of Directors, circumscribed by papers of incorporation, or a governmental Agency carrying out the provisions of a legislative act embark on a program, there may be many complicated phases to the preliminary planning and the simple statement regarding the purpose and policy is not so absurd.

In principle, it matters little whether the processes involved in the "execution of the mission" are those of merchandising, manufacturing or management: someone first determines the general "what, how, where and when" of the undertaking, and thereafter, local management and supervision assume the responsibility for operations under established policy. The dividing lines between "top-management" and local or specific management, between policy and procedure and even between supervision and supervised may be indistinct. In general, the distinctions are more apparent as the operation and organization increase in magnitude and complexity.

The functions of management may be summarized into (1) policy, (2) organization, and (3) methods, with the latter subdivided into (a) procedure, and (b) operational analysis. These are the functions of office management and industrial management alike. The flow of ore through a concentrator and the flow of documents through the payroll department, or of logs through a paper mill depend on the same managerial principles, whether it is called industrial engineering, business management, or by any other name.

Policy may be defined as the system of management, and the decisions which constitute the determination of policy are often reserved for top-management, by definition. However, this concept may be misleading as policy determinations, commensurate with the responsibility of a position are inherent in nearly every white-collar job, even though they are not dignified by the term, "policy." It is the product of judgment and is arbitrarily established so far as operations are concerned. Whether the accounting will be done manually, or by bookkeeping machines, or by electric accounting machines; and whether the employees will be bound by "shop rules," time clocks, and what they might consider regimentation, or whether they will be under an honor system based on company tradition, employee loyalty and good supervision, typify subjects for top-management policy determinations. Likewise the question of departmental budgeting of office supplies versus the free-stock system, the degree of control over correspondence, the adoption of incentive programs are matters subject to decision before operational procedures may be prepared. The policy making body is often guided in its decision by the consultation of staff groups or operating personnel and may even delegate certain of its responsibilities, but in all cases it is responsible for those broad determinations under which operations are worked out, proceed, and are improved.

Organization

Organization is the architecture of an establishment. It considers the human components, their respective functions, their groupings and their structural relationships. Being human, it has intelligence; and if it were possible for an establishment to have perfect organization, it would function perfectly because each person would know and carry out his relative and cooperative responsibility. A team of such persons would function without fumbles or errors and even without signals. Unfortunately we are all human and this idealogy merely represents a concept which we strive to approach through the use of organizational

techniques, the chief of which is supervision.

A supervisor is a person who coordinates the efforts of a number of other persons so that they will perform their duties with a minimum of errors. He may be a playing manager or a bench manager, but the thing that makes him a supervisor and the head of an element of the organization is his exercise of some measure of administrative authority.

Administrative authority may be defined as the right and responsibility to hire, fire, transfer and promote, or recommend such actions; to arrange and approve leave, overtime, and work schedules; to make decisions commensurate with his position; to instruct and direct the work of subordinates and pass judgment on their efficiency; and to assume the consequences for the accomplishments of the element.

A good supervisor should be versed in the general principles of management and the specific activities of his particular element, but, above all, he should know the capacity and operational characteristics of every human tool in his shop.

An organizational structure which is based on direct supervision and the exercise of administrative authority over persons, or supervisors in charge of organizational elements, is generally referred to as line organization. The popular example is found in the armed services, and it is often represented by heavy line on organizational charts.

Whenever an official is unable to exercise, personally, all of the administrative authority vested in his office, it may become necessary to expand the organization by adding personnel or even elements to furnish the needed assistance. Such supporting persons or elements are "staff" to the principal carrying out such special assignments and exercising such of the principal's administrative authority as may be delegated to them. Staff organization is usually charted by light lines.

Again, when the complexities of operation demand the services of specialists or technicians, a third type of organization, functional organization, becomes necessary. It implies the use of consulting and instruction services. With the sanction of higher line supervision, it exercises necessary administrative authority by delegation, but only within the scope of its specialty; and it can tie into line organization at any level. Functional relationships are conventionally charted by broken lines.

The organizational pattern depends primarily on the number of employees, and secondarily on the functions involved. Like functions should be grouped together but a small employment can justify only a simple structure regardless of the multiplicity of activities. Once the organizational policy is established, the organizational Manual can be prepared.

A complete organizational manual consists of four parts: (1) Introduction or General Section, (2) Organization Chart or Table of Elements, (3) Functional Statements, and (4) Staffing Pattern or position Charts.

The introduction should cover the principles enumerated above; the responsibilities common to all supervisors; the organizational levels, such as, "Office, Division, Branch, Section, Group;" and the method of controlling and revising the organization.

The Organizational Chart should show the line, staff, and functional organization with separate blocks for each element, showing its title, code number, and supervisor, and arranged to show the subdivision of larger elements into their components. Obviously, no element should be subdivided into less than two parts; nor can satisfactory supervision be given to an excessive number of components. When a Table of Elements is used in place of a chart, the subsidiary elements may be shown by relative indentations.

Functional statements for each element should enumerate all the important responsibilities and activities of the element. These statements should be brief, but not so generalized as to be vague or ambiguous. In the event of a subsequent question of overlapping duties between elements, or the discovery of an apparently unassigned responsibility, the functional statements should clarify the problem. Furthermore, these lists serve as master plan for the development of departmental instructions, job descriptions, and should be coordinated with published procedures.

The position chart or staffing pattern, lists the several jobs or positions under the immediate supervision of each element head. It should show at least the position titles and grades and the number of each. The position chart is the control or the individual job sheets and such personnel records as are maintained by the respective supervisors.

Procedures

Procedures are the blueprints of the white-collar production, and the complements of organization. Just as perfect organization would permit operations without instruction or guidance, so perfect procedural development would obviate the need for organization. Since neither is practicable, top management must establish a policy which utilizes both organization and procedures, considering the particular circumstances.

When an establishment is small or when the personnel have "grown-up" with the job, procedure is a matter of personal experience: the know-how is inherent or traditional; but with expansion the employment of new personnel, or changes in operating methods it often becomes necessary to formalize the procedure. The same factors which justify the organizational manual, justify the procedural manual. In the broadest aspect, procedures include all instructions pertinent to operations, but as in the issuance of construction blueprints or job tickets, it is necessary to go only so far, leaving the ultimate detail to established standards, shop practice or immediate supervision. So in procedures, the basic step is the policy determination of the types of procedural releases which will be utilized, the authority and scope of each type, and the method of controlling the issuance, distribution and observance of the several types of series. Separate series should be established for: (1) statements of policy, contractual requirements or legal provisions which govern the overall operation; (2) primary directives which prescribe or revise the methods to be used in executing broad phases of the mission, or which are binding on persons in more than one department and are applicable for an indefinite period of time; (3) instructions dealing with operations confined to one department and being of no concern to other departments; (4) notices, announcements and informational releases of a transitory nature. The issuance of these, with the possible exception of the departmental ones, should be centrally controlled. Important factors in the control are (1) assignment to the proper series and numbering, (2) assurance of proper prepublication clearance with operating officials concerned and against policy and outstanding directions, (3) editorial review for form, style, subject matter and possible ambiguity, (4) distribution and follow-up, and (5) cross-indexing and maintenance of the master file. Such a control over engineering blueprints in industry is a recognized necessity, but in the business world it is sometimes considered "red tape."

Closely allied to procedures control is form control. Many procedures may be established through the use of properly designed form, with or without instructions printed thereon, and since forms constitute the largest group of white-collar tools other than equipment items, a system of controlling them will often serve as the greatest single control of operations.

In any procedures control operation, a thoroughly cross-indexed library is essential, with an inactive section for historical reference to those procedures which at one time governed operations. Without a means of rescinding obsolete material and avoiding duplications in subject matter, the procedure manual will become too cumbersome and complex to be useful. Authorizations and dele-

gations, which are neither organization nor procedure, but have an important effect on each, should be indexed in the procedures library.

Procedure Writing

Much has been said about the art of writing — just as much has been said about industrial design — and the matter of "style" has been bantered from the functional to the aesthetic, with the erroneous implication that that which is fine, cultured and aesthetic is incompatible with the practical, stern, mundane realities of science and business. Procedure writing is a form of technical writing in that it must convey a positive message in an understandable and unequivocal manner for a practicable purpose.

Those releases which give orders, direct specific actions, provide instructions for processes, standardize practices, or show the flow of documents and materials are issued to effect the transition of policy into product and complement the organizational manual. They should be written in the imperative mode, or at least with the implication of demand. They comprise the "How Book," the "Bible" or the Procedure Manual. Unauthorized deviation is forbidden, and interpretation should be unnecessary.

Other releases, which are of a transitory nature such as announcements, information circulars, and morale building messages may be equally as official as procedures proper, but they should not be confused with those of a directive nature.

To prevent confusion, and primarily, to render the several releases readily understandable and useful, certain standards should be incorporated into the initial planning of the procedural releases and manual. A means (or department) for effecting central control over releases and assuring their coordination and authenticity, the types or series under which release will be issued and the major subjects — chapters in the procedure manual — should be established. A standardized format, editoral outline and method of duplication and distribution add to the effectiveness. Even a color scheme or code for releases on various phases can be good shop practice.

A very effective presentation of a procedure which involves the flow of paper is found in the technique long used in engineering, of a pictorial flow chart. Such a diagram provides areas for the several departments or work stations and shows the movement and stops of the documents and copies thereof. Since the question is more frequently, who makes out a form or to whom are the copies sent, rather than how is the form filled in, a pictorial flow chart with footnotes describing the operations is more useful than the more lengthy, narrative procedures, of utilizing process charts and of combining flow charts with narrative procedures, of utilizing process charts and of correlating procedures with operational instructions and position descriptions, should be kept in mind.

Operational control involves first an analysis of what is happening, in investigation of possibilities for improvement and, lastly, keeping the machinery running under the established or reestablished procedures. The profit and loss sheet may tell what is happening, unless it only reflects what did happen after it's too late. Operating reports and statistics when effectively used can be the gauges which measure efficiency, progress and output. When they are not used properly by operating and policy officials they may be only historical extravagances. Management surveys, work simplification, staff discussions and the practical ideas from an employee suggestion system can furnish the basis for improvements. Employee relation programs, incentive plans, morale-building house organs, and wise personnel management will keep the human tools and machinery running smoothly and in production.

Reports and Statistics

It is very easy to ask questions; and it is fascinating to "develop statistics." As a consequence, there is often a tendency for the statistical activity to expand out of proportion to its usefulness. On the other hand, it may be cheaper to accumulate a few extra facts as a by-product of production than have to reconstruct them through research at a later date if the need develops. Performance data and trends may be of great value in controlling and planning primary operations. Other data, of no immediate or local significance may be required by higher authority. Recurring reports, like continuous recording gauges, are the logical source of many statistics, but should be held to a minimum as should all other demands which might tend to detract from production. Special, one-time reports and the use of sampling techniques may prove more economical. Here, as in the case of many other refinements, the law of diminishing returns governs the extent to which it is practical to carry the activity.

In the development of statistics two points should be borne in mind, the significance of the statistic and the use to which it will be placed. The best of statistical analyses and presentations, if they are not put to use, are commercially valueless; and to attempt to utilize information of negative significance is futile. The problem is similar to that of tool design, and no tool designer would develop an expensive tool without first knowing why and how and by whom it would be used.

Methods Studies

There is always a better way. Hackneied as is this statement, it is as applicable in the office "paper mill" as it is in the industrial paper mill. The techniques of discovering the better ways, of analyzing the methods which are subject to improvement, are too numerous and complicated to be discussed here. Many of them are well known to every engineer who "thinks with a pencil," even though their application to white-collar operations may seem an innovation. One need only attempt to make a process-flow chart of the preparation of a multi-copy business form with supporting documentation, to see why there is some reluctance to apply engineering to office procedure. Equally impressive is the development of a cost accounting system for the products of most white-collar enterprises. Yet, the very complexities which such studies reveal, indicate the opportunity for work simplification and increased efficiency.

Many office processes are amendable to time study and work-load analysis; and this is especially true as the individuals performing these processes functionally approach mechanical tools. But even these human tools, being human, are possessed of intelligence, and any analysis should be modifled from its purely impersonal aspect by taking advantage of the inherent intelligence not found in the purely mechanical counterpart. This new factor in the otherwise conventional engineering technique may be considered as belonging to the employee relations activity; but it is poor management to believe that the two may be divorced.

Employee Relations

No machine is expected to operate satisfactorily without maintenance: tools must be sharpened, lubricated, cooled and repaired, and in some instances fatigue strains must be relieved. Likewise human tools must be maintained. True, the techniques are different! A machine tool can't tell us where it hurts, and if it is inclined to be tempermental we, unfortunately, have no way of predetermining that fact. Industrial equipment can't make suggestions to improve its own efficiency; but it can be driven unmercifully to the point of break down, with no greater damage than the cost of replacement. The parallel between the inanimate tool and the human tool is limited as already pointed out and as is unquestionably obvious.

The engineering concept, however, of office management, based as it is, on the purpose, the product, the raw materials, the tools, and the methods of the operation, can no more ignore the factor of employee relations than it can ignore the factor of maintenance in purely mechanical operations.

Thus, Engineering still may be considered as the "three-dimensional science," even when it comes in out of the rain and weather.

Notes From The President's Desk

Finances

It has occurred to me that many of our members naturally may have questioned from time to time about the finances of the Institute. Arrangements have been made with Keller-Kirschner-Martin & Clinger, certified public accountants of Columbus to audit the records and prepare a certified statement during the latter part of March. Such statement will be published in the next issue of the Journal. It is impossible to have it ready for this issue because the accounting firms are loaded between now and March 15th with the preparation of statements for stockholders' meetings of business corporations and tax returns.

For your information the system has been followed of deposit all receipts in an insured bank account to be withdrawn by the treasurer in payment of the approved expenses of the Institute. As of February 13th the balance on deposit was $1261.04 with a deposit of $304.05 in transit. The public statement will show a summarization of the expenses and the sources of revenue. The office of your Institute has been managed to make a maximum utilization of part-time student help and otherwise minimized expenses to assure adaquate funds for the continued development of the Journal and other objectives of the Institute.

Professional Registration

When the AMERICAN INSTITUTE was founded it was decided not to make professional registration with a State Board of Engineering registration mandatory for membership, but to encourage all IE's to seek registration. This was done because it was recognized that the large majority of men in our branch of the engineering profession are employed in factories and other organizations where there is less reason to be aware of the trend toward registration of engineers, than in public works engineering offices and similar establishments.

Instead, the policy was adopted of accepting registration as prima facie evidence of eligibility to belong to our organization. It is feared by some of the older members, however, that there is insufficient interest in registration on the part of the IE's. Within the confines of our own meetings and in a private publication such as this, it can be said that hardly any other branch has so much to gain by actively pushing the registration program. There are still many quarters in which it is contended that IE is not properly an engineering branch at all, and in fact there are some states wherein it is difficult, if not impossible, to obtain registration as an IE.

Nothing will contribute so handsomely to a public recognition of the importance of IE as for a large majority of the members to attain registration. There are powerful forces at work trying to limit registration to men who actually design bridges and other structures "directly affecting human life and safety". At least part of this opposition to registration of all engineers who are engaged in true professional work, stems from the fear of certain employers that when engineers understand their own position as members of an honored and ancient profession, it will no longer be possible to hire them for picayune salaries as is still too often the case.

Every chapter, both senior and student, should take an active interest in this problem and make every effort to increase the number of registered IE's. The logical thing is for all graduating seniors to take the exams as soon as they are eligible to do so. Men who have gotten out in employment without starting on their registration should also be encouraged in this direction and every chapter should make an effort to operate refresher courses to aid those who are to take the exams.

Many hesitate to take these exams for fear of displaying their ignorance. A proper environment can be established in chapters in which it will be clearly understood that the exams necessarily contain basic mathematics and other material which men out in practice do not use daily and therefore become rusty in handling. Thus it can be established that it is no disgrace to fail on the first attempt, but a mutual effort to brush up can be encouraged. On the other hand, in certain quarters exams have contained unreasonable questions, but a chapter operating as a chapter in cooperation with the national organization can take steps to persuade the authorities to correct such situations. Very often they are caused only by lack of understanding of what the IE's work really is.

Home Furnishing Cost Is Lowered

Young husbands furnishing homes get more for an hour's wages than their fathers could have 35 years ago, according to the National Industrial Conference Board. The board reports that 82 hours of work meet the annual house-furnishings bill of today's moderate-income family, while 95 hours of work had to be expended in 1914.

Machines Doing 92% of Work

In 1850, men accounted for 15% of farm-labor energy; animals contributed 79%; and machines only 6%. Now machines do an estimated 92% of the work; animals and men each account for only 4%. A century ago, the man-animal-machine farm team turned out 27 cents worth of produce in an hour. At today's prices its hourly output is valued at $1.41.

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Book Reviews

Applied Experimental Psychology

(Human Factors in Engineering Design)

by A. Chapanis, W. R. Gurner, and C. T. Morgan, John Wiley & Sons, New York, 1949. 439 pages.

Reviewed by Professor Robert T. Livingston, Head, Department of Industrial Engineering and Management, Columbia University.

Formal engineering machine design has passed through two distinct phases and is now entering a third. The design of a product or machine for strength, environmental limitations and performance goes back many years. Along about the time of the first world war there was a revolution in machine design; products were redesigned for production economies. Now we are entering the field of redesign for adaptation to the human being. Most people are familiar with so-called "Industrial Design" or "functional design" which, however, named, is largely a matter of redesign for eye appeal. However, the newest trend is far more than that.

A glaring lack in modern technology is in the design and adaptation of machines for the facilities and senses of man. Man has certain sensatory abilities and limitations and perceptions. Accuracy and speed of recognition and response are dependent upon the inclusion in the design of the machine, a recognition of man's perceptual faculties and his ability to translate these into responses.

This book is an important one for industrial engineers and especially those who are interested in design. Here for the first time is collected the available material in this important field. Much of what is here presented was previously "known" but the mistakes of the war and the growing complexity of the machines of war made test and proof of this knowledge necessary.

The field stems from two areas of industrial engineering: (1) time and motion study and job simplification and (2) personnel and applied psychology. Man's senses and faculties are studied and the use of the particular sense or faculty in relation to response is presented. Sight, hearing and sensatory recognition are presented and discussed especially in respect to man's ability to receive and recognize a stimulus and to properly respond.

The last few chapters of the book have to do with work and the work place and general environment and man's physiological as well as psychological reactions.

This is an interesting and valuable book and one more recognition that the worker has more than merely physical and economic needs.

Administrative Reflections of World War II

by Luther Gulick, The University of Alabama Press at University, Alabama, 1948. 139 pages.

Reviewed by Professor D. B. Hertz, Department of Industrial Engineering and Management, Columbia University.

This book attempts to encompass the broad experience of Dr. Gulick in dealing with the many serious administrative problems which arose in gearing this country's economy for global war and reconstructing the economy for peace time production during the period from 1939 to 1946. Professor Gulick is well qualified for the task, having been an outstanding authority on administration prior to the War, and having served in establishing the organizations and programs of numerous agencies, including the Control division of the War Department, the War Production Board, the Office of Organizational Planning, the Office of the Co-Ordinator for Inter-American Affairs, and others.

"Things happen fast in time of war. Men act along new lines boldly, decision jostling decision. Mistakes are made, and new approaches are sudden and frequent. This environment creates a situation which is extraordinarily fertile in institutional experimentation. If it is equally productive in demonstrating what will and will not work in peacetime administration, careful attention to our war experience may prove extremely rewarding for those whose prime consideration is found in the challenging problems of peace." Based on this premise, the book outlines a broad picture of administrative difficulties, accomplishments, and deficiencies which are clearly and logically drawn. In a remarkably short compass the lectures, from which this book has been drawn, present for the serious student of administration, as well as active administrators in any field, important lessons and conclusions which will add to the growing body of knowledge in this area.

Beginning with a panoramic sketch of the war years, the book proceeds to list the multitude of resources which were required to be coordinated in order to be effectively utilized. If the book is to be criticized, it would be on the ground that the background material presented is too meagre (for any but the most experienced in the myriad of wartime administrative agencies) for a proper understanding of the developments. As Mr. Gulick says, in the same vein as such writers as Gillispie, Follett, and Livingston, "administrative" developments, cannot be understood unless they are related (1) to their own organic past, and (2) to the compulsions of the environment in which they exist." It is too much to expect that both the past histories and then-existing compulsions would be outlined in detail in this small volume.

In discussing the background of the development of the war machine Gulick shows clearly that the common drive and environment gave rise to a more or less similar rythym of growth and adaptation in the various administrative agencies. The clear cut time factor points out that there may be a need for studies of such time elements in the field of organizational evolution.

With this background, the book turns to an outline of achievements and failures. Here we see that Dr. Gulick considers the general staff concept as a most important advance when applied to other than military organizations. With reference to failures, the important ones in Gulick's consideration were lack of proper and sufficient intelligence on the top level, and lack of comprehensive planning for what is clearly the basic resourse — manpower. The intimation that we must prepare a comprehensive manpower budget for both peace and war is a serious challenge to the industrial engineer. The complexities of such a master-plan are very great indeed, and the industrial engineer must accept the challenge to study the theory of such metrical formulations of policy in the future.

The last section of the book concerns itself with general and specific lessons to which students of administration may devote their attention. These lessons are of considerable interest, and are a concise presentation of administrative operations. The book closes with a clear cut, hard-headed outline or reasons for democratic superiority in administrative operations, which alone would be of great value in all of us. The book itself should be read by all those concerned with the theory and practise of administration, and it is only regrettable that it has not been expanded into a more complete work.

Dynamic Equipment Policy

by George Terborgh, Research Director, Machinery and Allied Products Institute, McGraw-Hill Book Co.

Reviewed by Professor Donald B. Wilcox, School of Industrial Engineering, Georgia Institute of Technology.

This book is an important contribution to an intensely important field of management decision and policy which has been woefully devoid of investi-

gation and authoritative, organized, constructive thinking. Proceeding from the known and admitted to the unknown and debatable, from the simple to the more complex, the author develops a most logical philosophy relative to problems of equipment analysis and investment.

This book is not easy reading but the subject matter is skillfully embellished with discerning diction. Illustrative problem situations have been kept to the barest minimum and in their place the reader is presented with two standard assumptions: (1) That future challengers (replacement possibilities) will repeat the adverse minimum of the present one, and (2) That the present challenger will accumulate operating inferiority at a constant rate. These assumptions are then applied to a variety of tests, in some cases with devastatingly critical comments as to current practises encountered in industrial plants.

The chapter on Problems of Estimation offers many helpful suggestions, as does the discussion of the topic of Interest Rate to be used in replacement studies. Fallacies encountered in arbitrary selection of Short-Pay-Off or Rate-of-Return requirements are examined and explained. In conclusion the author presents a sincere appeal for the adoption of his title topic, a Dynamic Equipment Policy, which will be both realistic and helpful.

This volume should appeal to anyone having to do with the formation of company policies relative to the selection of and investment in new or replacement equipment or facilities of any type. Plant managers will want their engineers to be conversant with the ideas expressed and superintendents will want to send their top executives a copy. It is a stimulating discussion of a live and vital topic with enough new and original concepts and thought provoking ideas to nudge the intellectual wheels of even the most complacent manager.

Recommended for Reading

"Keeping Stock Records of 36,000 Items Without Files" E. H. Titmus, Jr., General Manager, Titmus Optical Co., Inc., Petersburg, Va., *Factory*, November, 1949.

"Using Standard Data to Teach Time Study," J. N. Crone, Industrial Engineer, Penn Electric Switch Co., Goshen, Ind., *Factory*, September, 1949.

"Trends in Industry-Wide Bargaining," H. S. Hall, Director, Personnel Administration, Bigelow-Sanford Carpet Co., New York, N. Y., *Mechanical Engineering*, December, 1949.

"How Many Readings for a Time Study?," M. E. Mundel, Professor of Industrial Engineering, Purdue University, Lafayette, Ind., *Advanced Management*, 1949.

"Britain's Production Incentive Undermined by Socialist Planning," C. C. Harrington, Editor, *Mill and Factory*, December, 1949.

Atlanta Officers

Photographed at a recent dinner meeting of the Atlantic AIIE Chapter, the above officers are, left to right, (front) President, Prof. C. B. Foos, Georgia Tech; Vice President, Charles Bastedo, Industrial Engineer, Atlantic Steel Co.; (back) Secretary, Frank Taylor, Industrial Engineer, Cluett-Peabody, Inc.; Treasurer, Bob Eskew, Assistant Director, Georgia Tech Evening School.

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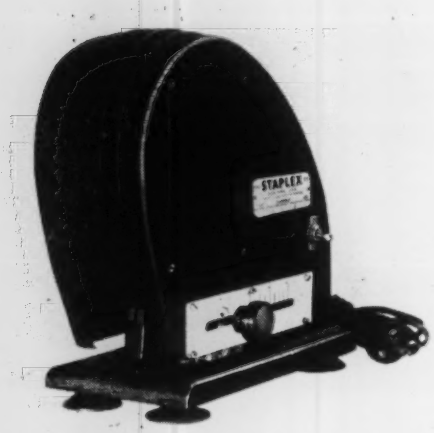


AUTOMATIC ELECTRIC STAPLING MACHINE

A single contact control provides instantaneous stapling of articles upon insertion into the Staplex automatic electric stapling machine. No waiting for "making and breaking" of electrical circuit is necessary.

The Stapling operation is entirely automatic. When articles to be stapled are inserted into the machine, contact is made and stapling is completed automatically. Operation is not dependent upon any timing by the operator.

Incorporated in the single contact control is a special construction to prevent repetition of stapling in the same position.

Another feature allows full regulated adjustment for entire depth of machine. A calibrated scale on the machine guides user in selecting proper stapling position. Turning control knob and moving forward or backward provides a simple and quick adjustment.

The flexibility of the machine allows unlimited use of articles to be stapled with utmost efficiency.

A standard staple is used, with a front feed. Reloading is quick — nothing to remove. Staples are fed through the front opening of machine.

Modernistically designed cast dural housing embodies entire machine. All moving parts are concealed. The machine does not have to be fastened. Rubber cushioned cups at base of housing allow it to be used everywhere. The Staplex automatic electric stapling machine is manufactured by the Staplex Company, 62-68 Jay St., Brooklyn 20, N. Y.

SCREWSTICK CUTS TIME

Screwstick is a one-piece stick of identical precision screws, each joined to its neighbor. Screwsticks load in a jiffy. Merely insert a screwstick into the pneumatic, electric, spiral, or hand-ratchet driver and the entire stick of screws will feed automatically.

Screwstick combines simplicity and speed of fastening with rivet-like strength, eliminates fumbling and tedious handling of individual screws regardless of size and insures alignment between screw and threaded hole. It eliminates any need for special skill in driving. It's "good-bye" too, to operator fatigue and eye-strain. Fastening efficiency zooms upward because neither operator nor driver speed determines tightness. Each screw contributes its full share of holding power.

Screws are twisted off automatically and the fastening is made when a predetermined torque is applied by the screwdriver to the screw following the

one driven. The amount of torque is controlled by cross sectional area of neck joining the screws. The neck can be varied to your requirements. The head of driven screw is burnished smooth by the next screw to be driven. As the tightened screw is freed from the neck, the next screw in line is automatically advanced by the driver.

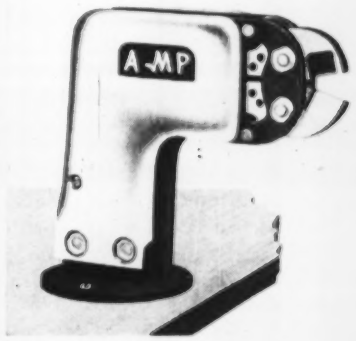
Screwstick is readily adapted to power screw driving, and will cut assembly time in half even when driven with spiral or hand screw drivers. Add to this cost-cutting factor, the savings from unmarred work, unfumbled screws, non-reject production, and you have the ideal fastening device.

Screwsticks are now available in diameters Nos. 0, 1, 2, 3, 4 and 5 in Mild Steel, Brass and Aluminum. The Mild Steel Screwsticks will be hardened for self-tapping when required. Research is being carried on to develop Screwstick in diameters 00 and 000, and in other metals, such as Stainless Steel, Nickel Silver and Monel Metal.

Write to the Thor Independent Automatic Tool Co., Aurora, Ill. for information on the driver and to American Screw Co., Providence, R. I., for information on Screwstick.

NEW BENCH PRESS

A low cost foot-operated bench press with cutting head has been developed by Aircraft-Marine Products, Inc. Tradenamed AMPli-Versal it does a clean cut-



ting job on wire, rod, or sheet metal and is so designed that the cutting head (supplied with the press) can be easily removed and any one of seven other special AMP heads quickly inserted. Other available heads perform such operations as indenting, knock-outs, nibbling, "U"-ing, notching, and installing AMP Solderless Terminals. Blank heads are also available.

The foot-operated AMPli-Versal comes equipped with cutting head. It is boxed complete with foot pedal, adjustable pedal rod, etc., ready to set-up. Requires minimum bench space.

Complete information on AMPli-Versal, Catalog #37450 and additional heads is available upon request to the manufacturer, Aircraft-Marine Products, Inc., 1715 North 4th St., Harrisburg, Pa.

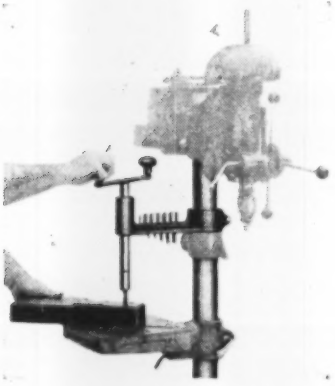
NEW TAPPING MACHINE

Paragon Metal Products, 8619¼ W. 3rd St., Los Angeles 48, has recently announced a new Hand Tapping Machine designed to eliminate tap breakage and to speed up tapping in the tool room and die shop.

This low cost Paragon Precision Hand Tapper is ready to use and can be quickly mounted on the drill press column as a permanent fixture. The drilling machine continues to serve not only as a drill press but also as an "always ready

for use" precision tapping machine.

By utilizing the drill press table and column a Precision Tapping Machine having the following features is obtain-



ed: Adjustable "Tap to table" clearance from 0 inches to 48 inches, a long 3½" spindle guide bearing to assure right angle tapping at all times, full 7½" depth of throat, ready mounting facilities.

The Paragon Precision Tapping Machine comes equipped with seven quick-change tap adapters. Sizes 8-32, 10-24, ¼", 5/16", ⅜", 7/16", ½". For further information write Paragon Metal Products, 416 S. Broadway, Los Angeles 13.

POSITIONETTE SIMPLIFIES ASSEMBLY OPERATIONS

The Positionette, a light, compact, durable, entirely self contained work positioner is factory assembled and ready for use. The table is quickly adaptable to practically all sizes and shapes of objects to be worked on. The handle gives the desired tension in adjusting the table to various working positions.

The Positionette is made of heavy cast aluminum, is 5½" high, weighs 1½ lbs. and its table measures 5¾" by 4". It is manufactured by Solor Foundry, Inc., 1510 University Road, Cleveland 13.

Dry Ice Is Made From Waste Gas

Alert for new ways to satisfy customers, a California company is making a profitable by-product out of waste hitherto removed by a somewhat expensive method. The company processes natural gas with a high percentage of carbon-dioxide, which until recently was taken out and thrown away. However, a new formula enables the company to turn the CO_2 into dry ice—much needed in the community.

Library Research

The United States Testing Co., 1415 Park Avenue, Hoboken, N. J., has announced a new "Library Research" service whereby, for a reasonable fee, business men may take advantage of the company's technical reference library.

This library, built up over a period of almost 70 years, contains thousands of volumes dealing with materials, products and manufacturing processes well indexed for ready reference. In addition, the company subscribes to some 150 trade publications dealing with new developments in the fields of Textiles, Chemistry, Engineering, Bacteriology, Production, Research and maintains an up to date file of Government and trade association specifications.

Technically qualified personnel work closely with trained librarians in the search for and evaluation of practical solutions to problems for immediate application. The company's close contact with dozens of major industries, frequently permits it to advise a manufacturer of a process or material in common use in one industry but totally unknown in another.

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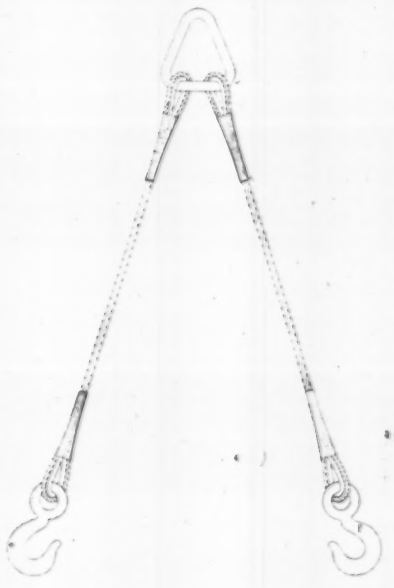

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Second Student Conference Planned

PROF. J. S. DWYER, of Georgia Institute of Technology has announced the dates and topics of the Student Management Conference at Atlanta, April 14-15, 1950. This is a follow-up on the gathering at the University of Alabama, which was acclaimed such a great success last spring. There will be speakers from industry, a banquet, a field trip and other high points.

The hosts are the Georgia Tech chapters of the American Institute of Industrial Engineers, Alpha Pi Mu, and Society for Advancement of Management. Invitations have been sent to a large number of colleges, to send delegations and to have at least one paper presented by each delegation. If you were missed do not be offended; it is a big task to work out the details of a meeting such as this. Instead write to Prof. Dwyer in care of the Industrial Engineering Department at Tech. You will be welcome of course if you merely drop in, but they would appreciate knowing how many are coming.

The general topic of the meeting is what the new graduate can expect when he takes his place in industry as an industrial engineer. Under this the following specific topics have been suggested; subjects for papers to be printed with of course any additional subjects that the members of the delegation might find desirable:

Selling Industrial Engineering to Your Employer.

The Advisability of Graduate Work in Industrial Engineering.

Insurance and the Industrial Engineer.

The Outlook for Jobs in 1950.

Research Work in Industrial Engineering.

The Industrial Engineer in a Consulting Service.

Getting the Right Start in the Industrial Engineering Profession.

Employees Help Modernize Plant

Cooperation between management and employes in planning changes was a major factor in modernizing a leather plant at Fond du Lac, Wis. One major objective during the operation was to keep production going at full speed all the time. Plant engineers consulted a committee of veteran employes, who presented ideas and built models of equipment to switch around in laying out the machines.

Professors Learn About Shop Work

To learn how work is done in the shop in addition to how the books say it should be done, 17 college professors from as many colleges and universities spent their 1949 vacations in the plants of an Eastern manufacturer.

All the professors worked in the shops where electrical machines are designed and built. Each specialized in the work he teaches.

Light Rays Piped In Twisted Tube

A tube of plastic perfected by industrial research will pipe light around corners; even makes it "loop-the-loop." Light entering one end of the tube is reflected by plastic walls so that none of it "leaks." It emerges at the other end of the tube in a concentrated spot.

Buying Machines To Aid Employees

TO LESSEN the physical strain of factory workers, industry is installing more and more labor-saving machinery.

The progress in lightening the traditional back-breaking job of foundrymen was reported recently by the superintendent of a plant at East Springfield, Mass.

Before a work-lightening program was undertaken, the foundry's 75 employes handled a total weight of 1,470 tons every day. A group of five "shake-out" operators removing sand and castings from poured molds, handled top weight of 65 tons each per day.

The superintendent said handling and re-handling materials accounted for 50 per cent of the cost of making small grey-iron castings.

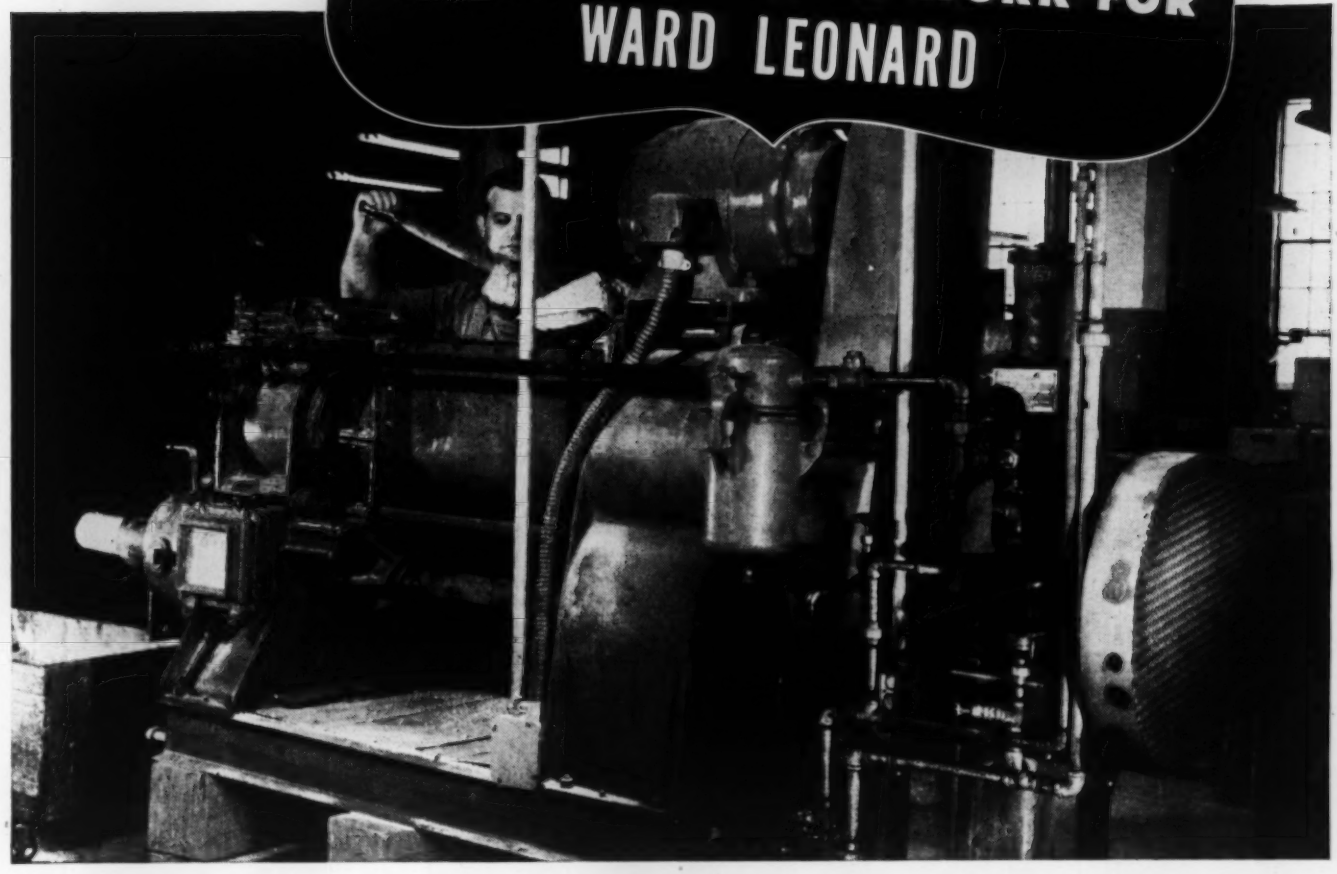
By modernizing the plant, the company ended all the manual lifting hitherto done by molders, who had been handling 22 tons each daily. The change boosted each molder's productivity by more than 50 per cent, and "apparently" solved the problem of getting men to do the work. The company reports it is now easier to hire new employes and keep experienced workers.

The work of the "shake-out" operators who handled 65 tons per day was completely mechanized. Total weight handled by all 75 employes was reduced from 1,470 tons to 294 tons.

More than a dozen hard jobs became mere push-button operations. Gasoline-powered trucks began moving heavy materials. In addition, a new ventilation and dust removal system was installed.

"To compete for work and labor, it is necessary to take every advantage of every available means for reducing expense and effort," the superintendent said. — *Exchange.*

THIS F-R-H Pug Mill HAS TO BE GOOD TO WORK FOR WARD LEONARD



"Production speeded up . . . low cost maintenance . . . improvement over other types," Ward Leonard Electric Company says of its F-R-H Pug Mill. And Ward Leonard should know, for this famous Mount Vernon, N. Y., company has tried other machines and other methods during its 55 years of producing top quality electric control devices.

Ward Leonard's enthusiasm for its F-R-H Pug Mill is nothing new. For F-R-H owners everywhere praise F.R.H's speed and economy. Ward Leonard's F-R-H Pug Mill is being used now for the fast, economical production of compressed ceramic material and for extruding the blanks from which Ward Leonard Vitrohm resistors are made.

Let F-R-H speed *your* production . . . cut your costs . . . and add these savings to your profits. F-R-H Pug Mills are available in a complete range of sizes from small table top laboratory mills to large production line models. Write today for your copy of the F-R-H Bulletin. Let it help you solve your production problems. The Fate-Root-Heath Co., Dept. B-6, Plymouth, Ohio.

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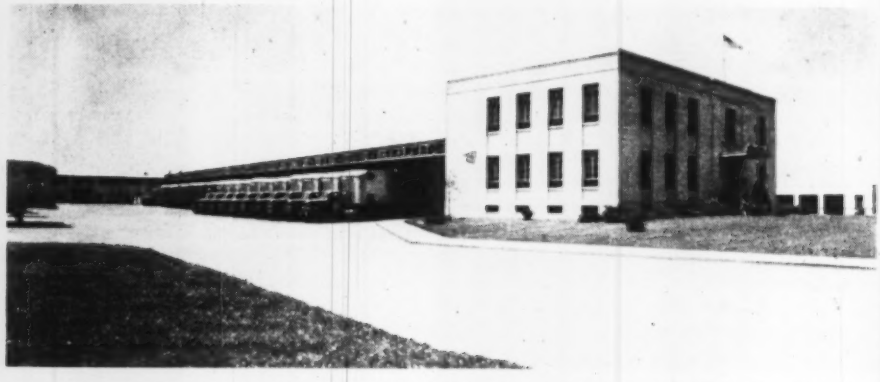

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AMERICAN INSTITUTE OF INDUSTRIAL ENGINEERS
National Headquarters
214 Industrial Engineering Building
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NEWS LETTER

NEWS LETTER RESUMED

WE ARE RESUMING PUBLICATION OF THE NEWS LETTER BECAUSE OF THE DIFFICULTY THAT HAS BEEN EXPERIENCED IN MAINTAINING PUBLICATION OF THE JOURNAL OF INDUSTRIAL ENGINEERING. THE PUBLISHING COMPANY WHICH DID SUCH A SPLENDID JOB OF GETTING OUT THE LAST ISSUE OF THE JOURNAL HAS EXPERIENCED CONSIDERABLE DIFFICULTY IN MAINTAINING AN ADEQUATE EDITORIAL AND PRODUCTION STAFF AND HAS BEEN UNABLE TO CARRY ON THE NECESSARY ADVERTISING SOLICITATION AND PREPARATION WORK. IN SPITE OF THE SPLENDID WORK DONE BY PROFESSOR GROSECLOSE AND THE ASSOCIATE EDITORS, THERE IS STILL SO MUCH THAT MUST BE DONE IN THE PRINTING OFFICE THAT IT IS IMPOSSIBLE TO PUBLISH A MAGAZINE WITHOUT A STRONG PRODUCTION STAFF. FORTUNATELY, IT APPEARS THAT THIS DIFFICULTY IS BEING CORRECTED AND WE HOPE THAT THE JOURNAL WILL BE RESUMED SHORTLY. IN THE MEANTIME, THIS LETTER WILL SERVE TO KEEP OUR MEMBERSHIP IN TOUCH WITH EACH OTHER.

ALL CHAPTER SECRETARIES ARE URGED TO BE DILIGENT IN SENDING REPORTS TO THE NATIONAL HEADQUARTERS, REGULARLY, AND IT IS REQUESTED THAT THESE BE WRITTEN IN SUCH FORM THAT THEY CAN BE INCORPORATED IN THE NEWS LETTER WITH A MINIMUM OF EDITING. INSTEAD OF WRITING A COMPLETE LETTER CONTAINING THE INFORMATION IT IS SUGGESTED THAT A BRIEF TRANSMITTAL LETTER BE USED STATING THAT THERE IS ENCLOSED AN ARTICLE WHICH YOU DESIRE TO HAVE INCORPORATED IN THE NEWS LETTER.

CHAPTER FORMATION

BECAUSE OF THE YOUTH OF OUR ORGANIZATION THERE ARE STILL MANY MEMBERS WHO DO NOT HAVE THE BENEFIT OF BELONGING TO LOCAL CHAPTERS AND MEETING WITH THEIR COLLEAGUES. THIS IS STILL TRUE IN AREAS WHERE THERE ARE ENOUGH MEMBERS TO PERMIT THE FORMATION OF CHAPTERS, OR AT LEAST WHERE THERE ARE ENOUGH POTENTIAL MEMBERS.

THE FORMATION OF A CHAPTER IS A TASK WHICH MUST BE ACCOMPLISHED LOCALLY. THE NATIONAL HEADQUARTERS CAN ASSIST BY PUTTING MEMBERS IN TOUCH WITH EACH OTHER, FURNISHING INFORMATION ABOUT THE STEPS TAKEN BY THE OTHER GROUPS WHICH HAVE MET THE PROBLEM SUCCESSFULLY, SENDING OUT LITERATURE AND IN OTHER INDIRECT WAYS, BUT IN EACH CASE THERE MUST BE A LOCAL GROUP INTERESTED IN GETTING THE WORK STARTED.

THE REWARDS FOR THOSE WHO PARTICIPATE IN FORMING AND OPERATING A CHAPTER ARE SUBSTANTIAL. ALTHOUGH THEY ARE NOT DIRECTLY CASHABLE AT A BANK THEY ARE REALIZED IN GOOD FELLOWSHIP, PROFESSIONAL PROGRESS AND MANY OTHER WAYS.

IT IS SUGGESTED THAT CHAPTERS BE FORMED WHEREVER THERE ARE TEN MEMBERS OR MEMBERS AND QUALIFIED PROSPECTS WHO CAN BE SIGNED UP. EXPERIENCE HAS SHOWN THAT STARTING WITH A SMALL GROUP PROVIDES A DEFINITE NUCLEUS THAT ATTRACTS OTHERS, MORE THAN JUST PROPOSALS TO GET TOGETHER AS A CHAPTER AT SOME LATER DATE. WHERE THE CHAPTER CANNOT BE STARTED AT ONCE, IT IS SUGGESTED THAT THOSE WHO ARE INTERESTED IN WORKING ON THE PROJECT CONSTITUTE THEMSELVES AS THE _____ CHAPTER ORGANIZING COMMITTEE. WE WILL IMMEDIATELY SEND YOU A COPY OF THE CHAPTER ORGANIZATION MANUAL, ON REQUEST.

PROFESSIONAL REGISTRATION

WHEN THE AMERICAN INSTITUTE WAS FOUNDED IT WAS DECIDED NOT TO MAKE PROFESSIONAL REGISTRATION WITH A STATE BOARD OF ENGINEERING REGISTRATION MANDATORY FOR MEMBERSHIP, BUT TO ENCOURAGE ALL IE'S TO SEEK REGISTRATION. THIS WAS DONE BECAUSE IT WAS RECOGNIZED THAT THE LARGE MAJORITY OF MEN IN OUR BRANCH OF THE ENGINEERING PROFESSION ARE EMPLOYED IN FACTORIES AND OTHER ORGANIZATIONS WHERE THERE IS LESS REASON TO BE AWARE OF THE TREND TOWARD REGISTRATION OF ENGINEERS THAN IN PUBLIC WORKS, ENGINEERING OFFICES AND SIMILAR ESTABLISHMENTS.

INSTEAD, THE POLICY WAS ADOPTED OF ACCEPTING REGISTRATION AS PRIMA FACIE EVIDENCE OF ELIGIBILITY TO BELONG TO OUR ORGANIZATION. IT IS FEARED, BY SOME OF THE OLDER MEMBERS, HOWEVER, THAT THERE IS INSUFFICIENT INTEREST IN REGISTRATION ON THE PART OF THE IE'S. WITHIN THE CONFINES OF OUR OWN MEETINGS AND IN A PRIVATE PUBLICATION SUCH AS THIS, IT CAN BE SAID THAT HARDLY ANY OTHER BRANCH HAS SO MUCH TO GAIN BY ACTIVELY PUSHING THE REGISTRATION PROGRAM. THERE ARE STILL MANY QUARTERS IN WHICH IT IS CONTENDED THAT IE IS NOT PROPERLY AN ENGINEERING BRANCH AT ALL, AND IN FACT THERE ARE SOME STATES WHEREIN IT IS DIFFICULT IF NOT IMPOSSIBLE TO OBTAIN REGISTRATION AS AN IE.

NOTHING WILL CONTRIBUTE SO HANDSOMELY TO A PUBLIC RECOGNITION OF THE IMPORTANCE OF IE AS FOR A LARGE MAJORITY OF ITS MEMBERS TO ATTAIN REGISTRATION. THERE ARE POWERFUL FORCES AT WORK TRYING TO LIMIT REGISTRATION TO MEN WHO ACTUALLY DESIGN BRIDGES AND OTHER STRUCTURES "DIRECTLY AFFECTING HUMAN LIFE AND SAFETY." AT LEAST PART OF THIS OPPOSITION TO REGISTRATION OF ALL ENGINEERS WHO ARE ENGAGED IN TRUE PROFESSIONAL WORK STEMS FROM THE FEAR OF CERTAIN EMPLOYERS THAT WHEN ENGINEERS UNDERSTAND THEIR OWN POSITION AS MEMBERS OF AN HONORED AND ANCIENT PROFESSION, IT WILL NO LONGER BE POSSIBLE TO HIRE THEM FOR PICAYUNE SALARIES AS IS STILL TOO OFTEN THE CASE. EVERY CHAPTER, BOTH SENIOR AND STUDENT, SHOULD TAKE AN ACTIVE INTEREST IN THIS PROBLEM AND MAKE AN EFFORT TO INCREASE THE NUMBER OF REGISTERED IE'S. THE LOGICAL THING IS FOR ALL GRADUATING SENIORS TO TAKE THE EXAMS AS SOON AS THEY ARE ELIGIBLE TO DO SO. MEN WHO HAVE GOTTEN OUT INTO EMPLOYMENT WITHOUT STARTING ON THEIR REGISTRATION SHOULD ALSO BE ENCOURAGED IN THIS DIRECTION AND EVERY CHAPTER SHOULD MAKE AN EFFORT TO OPERATE REFRESHER COURSES TO AID THOSE WHO ARE TO TAKE THE EXAMS.

MANY HESITATE TO TAKE THE EXAMS FOR FEAR OF DISPLAYING THEIR IGNORANCE. A PROPER ENVIRONMENT CAN BE ESTABLISHED IN CHAPTERS IN WHICH IT WILL BE CLEARLY UNDERSTOOD THAT THE EXAMS NECESSARILY CONTAIN BASIC MATHEMATICS AND OTHER MATERIAL WHICH MEN OUT IN PRACTICE DO NOT USE DAILY AND THEREFORE BECOME RUSTY IN HANDLING. THUS IT CAN BE ESTABLISHED THAT IT IS NO DISGRACE TO FAIL ON THE FIRST ATTEMPT, BUT A MUTUAL EFFORT TO BRUSH UP CAN BE ENCOURAGED. ON THE OTHER HAND, IN CERTAIN QUARTERS EXAMS HAVE CONTAINED UNREASONABLE QUESTIONS, BUT A CHAPTER OPERATING AS A CHAPTER IN COOPERATION WITH THE NATIONAL ORGANIZATION CAN TAKE STEPS TO PERSUADE THE AUTHORITIES TO CORRECT SUCH SITUATIONS. VERY OFTEN THEY ARE CAUSED ONLY BY A LACK OF UNDERSTANDING OF WHAT THE IE'S WORK REALLY IS.

INDUSTRIAL ENGINEERING ORGANIZATIONS

IT HAS COME TO THE ATTENTION OF THE OFFICERS OF THE AIIE THAT SOME PEOPLE ARE CONFUSING OUR ORGANIZATION WITH OTHERS WHICH DESCRIBE THEMSELVES AS SOCIETIES OF INDUSTRIAL ENGINEERS UNDER VARIOUS NAMES. SO FAR AS WE KNOW OURS IS THE ONLY ONE THAT IS MADE UP EXCLUSIVELY OF MEN WHO HAVE HAD PROFESSIONAL TRAINING IN OUR BRANCH OF THE PROFESSION.

ONE POINT WHICH HAS BEEN REFLECTED IN LETTERS RECEIVED IN THE NATIONAL HEADQUARTERS IS THAT SOME OF THE SOCIETIES HAVE ENDORSED COMMERCIAL PRODUCTS. SO FAR THE AIIE HAS DEFINITELY NOT ISSUED ANY ENDORSEMENTS, AWARDED ANY PRIZES OR OTHERWISE INDICATED PREFERENCE FOR ANY MANUFACTURED ARTICLE OR COMMODITY. TO DO SO WOULD REQUIRE A MAJOR CHANGE OF POLICY AND WOULD HAVE TO BE REFERRED TO THE MEMBERSHIP FOR ADOPTION. THEREFORE, IF ANYONE EVER QUESTIONS YOU ABOUT OUR GROUP HAVING RECOMMENDED CERTAIN ITEMS YOU MAY STATE EMPHATICALLY THAT IT WAS NOT YOUR ASSOCIATION.

IT WOULD BE VERY HELPFUL IF ANY AND ALL MEMBERS HAVING INFORMATION ABOUT THE OPERATIONS OF OTHER ORGANIZATIONS PURPORTING TO BE INDUSTRIAL ENGINEERS WOULD SEND A REPORT TO THE PRESIDENT. IF THERE ARE ANY OTHER GROUPS WITH EQUALLY HIGH STANDARDS, WE WOULD LIKE TO COOPERATE WITH THEM. IF THERE ARE GROUPS WITHOUT STANDARDS WE WOULD LIKE TO KNOW ABOUT THEM TO MAKE THE PROPER DISTINCTION BETWEEN THEM AND OURSELVES.

NATIONAL CONVENTION

AT THE LAST MEETING OF THE EXECUTIVE COMMITTEE, A MOTION WAS PASSED TO ACCEPT THE INVITATION OF THE CLEVELAND CHAPTER TO HOLD THE 1951 NATIONAL CONVENTION IN THAT CITY. ARRANGEMENTS HAVE BEEN MADE WITH THE STATLER HOTEL FOR A MEETING ON SATURDAY, JUNE 16TH AND IT IS URGED THAT ALL MEMBERS NOW RESERVE THAT DATE AND BEGIN TO LOOK FOR COMPANY TRIPS OR OTHER EXCUSES TO MAKE OFFICIAL TRAVEL TO CLEVELAND AT THAT TIME.

THE NATIONAL CONVENTION HELD IN COLUMBUS AT THE DESHLER-WALLICK HOTEL ON SATURDAY, JUNE 17TH WAS A GREAT SUCCESS. APPROXIMATELY 100 MEMBERS AND GUESTS ATTENDED. A FINE ADDRESS WAS MADE BY MR. R. CONRAD COOPER, VICE PRESIDENT, INDUSTRIAL ENGINEERING, OF THE UNITED STATES STEEL CORPORATION. COPIES OF HIS TALK, "THE INDUSTRIAL ENGINEER'S PLACE ON THE MANAGEMENT TEAM" ARE AVAILABLE TO THOSE WHO ARE INTERESTED.

THREE FELLOWS OF THE AMERICAN INSTITUTE OF INDUSTRIAL ENGINEERS WERE ELECTED. DEAN CHARLES E. MACQUIGG OF THE COLLEGE OF ENGINEERING AT OHIO STATE UNIVERSITY PRESENTED THE CERTIFICATE OF FELLOW POSTHUMOUSLY TO JOHN YOUNGER AND THE AWARD WAS ACCEPTED BY MRS. YOUNGER. CERTIFICATES WERE ALSO PRESENTED TO DR. LILLIAN GILBRETH AND TO MR. COOPER.

THE MEETING WAS PRESIDED OVER BY MR. JOHN COLEMAN, VICE PRESIDENT OF THE NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS. MR. DWIGHT GARDNER, RETIRING PRESIDENT, INSTALLED MR. ROBERT E. ALLEN AS HIS SUCCESSOR.

DIRECTORY MAILED

DURING THE PAST FEW WEEKS COPIES OF A MEMBERSHIP DIRECTORY (AS OF JUNE 1950) WERE MAILED TO ALL OF THE MEMBERS FOR WHOM WE HAD CORRECT ADDRESSES. IF YOU DID NOT RECEIVE A COPY OF THE DIRECTORY THERE ARE STILL A NUMBER AVAILABLE AND ONE WILL BE MAILED TO YOU UPON REQUEST. THERE ARE A NUMBER OF ERRORS IN THE DIRECTORY BECAUSE IT TOOK MANY WEEKS TO PREPARE AND CHANGES OCCURED DURING THE TIME OF ITS PREPARATION AND, IN SOME INSTANCES, THE INFORMATION AVAILABLE IN OUR FILES AT THE TIME OF BEGINNING THE PROJECT WAS NOT CORRECT.

IT IS HOPED THAT THE FIRST ISSUE WILL STIMULATE MEMBERS TO KEEP THE HEADQUARTERS OFFICE FURNISHED WITH INFORMATION SO THAT AT A LATER DATE A NEW DIRECTORY MAY BE PUBLISHED THAT WILL BE MORE COMPLETE. THE FIRST ISSUE COMPRISED MORE THAN SEVENTY PAGES AND ENDEAVORS TO GIVE BRIEF BIOGRAPHICAL INFORMATION ABOUT EACH MEMBER INSTEAD OF MERELY PRESENTING NAME AND ADDRESS.

OFFICE SECRETARY

ONE OF THE GREAT DIFFICULTIES OF ADMINISTRATIVE OPERATION EXPERIENCED BY THE INSTITUTE IN THE PAST WAS THE NECESSITY OF USING PART-TIME STUDENT HELP. IN THE BEGINNING WHEN THE VOLUME OF WORK WAS SMALL, THIS WAS AN ADVANTAGE BECAUSE THE TIME PURCHASED COULD BE ADJUSTED EXACTLY TO THE AMOUNT OF WORK TO BE DONE. HOWEVER, AS THE ORGANIZATION GREW IT BECAME IMPOSSIBLE TO HANDLE THE MANY PROBLEMS IN THIS MANNER. WE ARE THEREFORE PROUD TO REPORT THAT WE NOW HAVE MISS CHARLOTTE PATTERSON AS THE OFFICE SECRETARY AND THAT SHE IS DEVOTING HER FULL TIME TO ENGINEERING SOCIETY WORK, EITHER WITH THE AIIE OR WITH THE OHIO ENGINEERS' PLACEMENT SERVICE, INC. MISS PATTERSON IS AN EXPERIENCED SECRETARY WHO IS IN THE PROCESS OF WORKING OUT OF THE DIFFICULTIES CREATED DURING THE PERIOD WHEN WE DID NOT HAVE ADEQUATE SECRETARIAL HELP.

BECAUSE OF THE CHANGE NOW MADE, THOSE MEMBERS WHO HAVE HAD TO WAIT LONG PERIODS FOR REPLIES TO LETTERS OR WHO HAVE RECEIVED BILLS FOR DUES ISSUED IN ERROR, OR HAVE OTHERWISE EXPERIENCED DIFFICULTY, MAY REST ASSURED THAT ADMINISTRATION WILL FLOW MUCH MORE SMOOTHLY IN THE FUTURE.

SECOND ANNIVERSARY

OUR SOCIETY HAD ITS SECOND ANNIVERSARY ON JANUARY 12, 1951, HAVING BEEN IN EXISTENCE FOR THREE YEARS. IN THIS TIME THE IDEA OF A PROFESSIONAL TECHNICAL INSTITUTE OF INDUSTRIAL ENGINEERS HAS "CAUGHT ON" TO AN AMAZING DEGREE. WE NOW HAVE 8 CITY CHAPTERS AND 14 STUDENT CHAPTERS AND GROWTH IS BEING MADE EACH MONTH. THE MEMBERSHIP TOTALS MORE THAN 2500 MEN.

OF COURSE THERE ARE SOME WHO HAVE BEEN DISAPPOINTED BECAUSE GROWTH HAS NOT BEEN FASTER AND BECAUSE THE ORGANIZATION HAS NOT OFFERED MORE SERVICES TO MEMBERS. BUT WHEN WE LOOK AT THE PROBLEM OBJECTIVELY AND CONSIDER THAT THREE YEARS AGO THERE WAS NOTHING, IT CAN BE SEEN THAT THERE IS AMPLE ROOM FOR PRIDE INSTEAD OF APOLOGIES.

CONTRAST OUR SITUATION WITH SOME OF THE OTHER ENGINEERING SOCIETIES WHICH HAVE BEEN OPERATING FOR SCORES OF YEARS. CONSIDER THE FACT THAT THE GREATER PART OF THE MEN IN THE FIELD OF INDUSTRIAL ENGINEERING ARE COMPANY EMPLOYEES. THEY DO NOT HAVE THE PROFESSIONAL IDENTIFICATION IN THEIR WORK THAT MEN IN SOME OTHER BRANCHES HAVE. THERE IS A GREAT TENDENCY TO LOSE SIGHT, WHEN ONE HOLDS A POSITION AS A SALESMAN OR A PRODUCTION MANAGER, OF THE FACT THAT HE IS ALSO A MEMBER OF A PROFESSIONAL GROUP.

NEW NATIONAL HEADQUARTERS

BECAUSE OF THE GROWTH IN MEMBERSHIP AND NUMBER OF CHAPTERS, THE ADMINISTRATIVE PROBLEMS OF THE NATIONAL HEADQUARTERS REQUIRED MORE OFFICE SPACE. TEMPORARILY A SMALL ROOM WAS RENTED AT 145 NORTH HIGH STREET. NOW ARRANGEMENTS HAVE BEEN WORKED OUR FOR ADEQUATE SPACE AT 40 WEST GAY STREET, AS A SUB-TENANT OF THE OHIO SOCIETY OF PROFESSIONAL ENGINEERS. THIS WILL BE ADVANTAGEOUS BECAUSE MISS PATTERSON, OUR OFFICE SECRETARY, ALSO WORKS PART TIME FOR THE OHIO ENGINEERS PLACEMENT SERVICE, AND THUS WILL ALWAYS BE AVAILABLE DURING BUSINESS HOURS.

WITH OUR OWN HOME IN A GOOD DOWN TOWN OFFICE BUILDING, WE HAVE CONCLUDED ANOTHER STEP IN THE GROWING UP OF AIIE, AND WE WILL BE ABLE TO RENDER MORE AND BETTER SERVICE TO MEMBERS.

NO ENDORSEMENTS

AS MENTIONED ELSEWHERE, AIIE HAS NOT ENDORSED ANY COMMERCIAL PRODUCTS. ALL MEMBERS ARE REQUESTED TO AID IN MAKING IT CLEAR TO THE PUBLIC THAT WE ARE NOT A PARTY TO ANY SCHEMES FOR LENDING PROFESSIONAL STANDING TO BEER, AUTOMOBILES, WASHING MACHINES OR OTHER PRODUCTS.

THERE IS AN ORGANIZATION IN CHICAGO CALLED THE AMERICAN SOCIETY OF INDUSTRIAL ENGINEERS WHICH HAS EMBARKED UPON THE PROJECT OF GRANTING ENDORSEMENTS. THIS PRESENTS A GREAT PROBLEM TO OUR SOCIETY BECAUSE OF THE CONFUSION IN THE PUBLIC MIND. THE COMPANIES WHO RECEIVE ENDORSEMENTS OF THEIR PRODUCTS HAVE LARGE ADVERTISING BUDGETS AND WE CANNOT HOPE TO COMPETE IN THE MATTER OF MAKING PUBLIC THE FACT THAT WE ARE NOT INVOLVED.

AS OUR MEMBERS WELL KNOW, THE AIIE IS A TECHNICAL PROFESSIONAL SOCIETY WITH HIGH STANDARDS FOR MEMBERSHIP. IT DOES NOT SEEM THAT IT IS ETHICAL FOR ANY PROFESSIONAL ORGANIZATION TO MAKE SUCH ENDORSEMENTS. THE SITUATION IS NOT YET COMPARABLE TO THE ENDORSEMENTS BY THE AMERICAN MEDICAL ASSOCIATION.

CLEVELAND WORK FACTOR CONFERENCE GREAT SUCCESS

A REPORT JUST RECEIVED REVEALS THAT MORE THAN THREE HUNDRED PERSONS ATTENDED THE 1951 INDUSTRIAL ENGINEERING CONFERENCE AT THE STATLER HOTEL IN CLEVELAND ON FRIDAY FEBRUARY 9TH. THE MEETING WAS VERY WELL PUBLICIZED, THE COMMITTEE GOT OUT MORE THAN 14,000 DIRECT MAIL PIECES OF ANNOUNCEMENT. THIS IS AN EXCELLANT PRELIMINARY TO THE 1951 NATIONAL CONVENTION WHICH WILL BE HELD IN CLEVELAND.

ATTENDING ENGINEERS HEARD TALKS BY MESSRS. QUICK AND GODWIN OF THE STAFF OF THE WORK-FACTOR COMPANY IN WHICH THE GENERAL OUTLINES OF THE SYSTEM WAS GIVEN AND THEN DIVIDED INTO GROUPS FOR DISCUSSION OF SPECIFIC PHASES OF THE APPLICATION OF THE WORK-FACTOR SYSTEM. THE LEADERS OF THESE SECTION MEETINGS AND THEIR SUBJECTS WERE: STEWART WEBSTER, CHIEF TIME STUDY ENGR. G. E. ERIE WORKS, REFRIGERATOR ASSEMBLY; FRANK BADGER, BELL & HOWELL CO., STANDARD DATA; ROBERT BLAIR, BELL & HOWELL, MACHINE SHOP PROBLEMS; PAT BRADY, SYLVANIA ELEC. BUFFALO, IND. ENG. ELECTRIC ASSEMBLY; HARRY MCNAMARA, CHIEF IND. ENGR. RCA-VICTOR CAMDEN, PROJECTION WELDING; WM. RILEY, PERSONNEL DIRECTOR ANNACONDA WIRE & CABLE CO, ASSEMBLY OF HEAVY MATERIAL; G. A. WELLING, CHIEF IND. ENGR. OSBORNE MFG. CO., CLEVELAND, PLANT MAINTENANCE; OTTO WOERNER VICE PRES. H. H. BROWN SHOE CO. WORCESTER MASS. SHOE MFG.; JAS DUCAN, PARTNER IN WORK FACTOR CO., CLERICAL OPERATIONS AND JOHN TAGGART ALSO OF WORK FACTOR CO. ON COTTON WINDING

AT LUNCHEON BRIGADIER GENERAL H. F. SAFFORD, NOW PRESIDENT OF THE OHIO RUBBER COMPANY WAS SCHEDULED TO TALK ABOUT IND. ENGR. AS APPLIED TO THE ARMAMENT PROGRAM. INSTEAD HE CHOSE TO GIVE HIS VIEWS OF THE RELATIONS BETWEEN TOP BRASS AND INDUSTRY. THIS WAS VERY WELL RECEIVED BY THE GROUP AND FAVORABLY REPORTED IN THE CLEVELAND PLAIN DEALER. THE CLEVELAND CHAPTER IS TO BE CONGRATULATED ON ITS INITIATIVE AND COURAGE IN PLANNING THIS VENTURE AND FOR THE SUCCESS WITH WHICH IT WAS EXECUTED.

DAYTON CHAPTER HAS "M T M" MEETING

ON MONDAY FEBRUARY 5TH, THE DAYTON CHAPTER MET JOINTLY WITH THE INDUSTRIAL METHODS SOCIETY OF THAT CITY FOR A PROGRAM BY SERGE A. BIRN, "HOW M T M CAN HELP WAR PRODUCTION". THE ATTENDANCE WAS VERY GOOD AND THE MEMBERS OF BOTH ORGANIZATIONS REPORTED THAT THEY HAD GAINED MUCH FROM THE MEETING. ON DECEMBER 5TH THE DAYTON GROUP HELD THEIR ANNUAL BANQUET AND HAD THEIR WIVES AS GUESTS. PROF. JOHN GEDEON, PSYCHOLOGIST, TALKED ON MENTAL PROCESSES, IN A WAY THAT WAS AT THE SAME TIME INSTRUCTIVE AND VERY ENTERTAINING. MEMBERS OF THE CHAPTER, HARRY PLACKE AND HIS "FUNSTERS" ADDED TO THE ENJOYMENT OF THE EVENING.

COLUMBUS CHAPTER FALL OPENER

THE FALL OPENER OF THE COLUMBUS CHAPTER WAS HELD AT THE PLANT OF THE ORAN COMPANY WHERE THE MEMBERS WERE GUESTS OF MR HENRY W. KELLY FOR A FINE BUFFET SUPPER. FOLLOWING THE SUPPER THEY WERE CONDUCTED ON A TOUR OF THE PLANT BY MR. KELLY AND PROF. W. G. STANTON, WHO HAS LEFT THE OHIO STATE UNIVERSITY AND ACCEPTED A POSITION AS MR. KELLY'S ASSISTANT. THE REMAINDER OF THE EVENING WAS DEVOTED TO A DISCUSSION OF PRODUCTION CONTROL AND OTHER IE PROBLEMS IN A SMALL PLANT.

OTHER CHAPTER NEWS

IT IS HOPED THAT WITH THE RESUMPTION OF THE NEWS LETTER THAT EACH OF THE CHAPTERS WILL BE MORE CAREFUL ABOUT SENDING IN REPORTS OF ITS ACTIVITIES. IT WILL BE IMPOSSIBLE IN THIS ISSUE TO REPORT ALL OF THE FINE MEETINGS THAT HAVE COME TO THE ATTENTION OF THE NATIONAL HEADQUARTERS, BUT WE ARE ALSO CERTAIN THAT THERE HAS BEEN A GREAT DEAL OF ACTIVITY WHICH HAS NOT BEEN REPORTED. OKLAHOMA A & M STUDENT CHAPTER - THIS GROUP PUBLISHES A FINE BULLETIN CALLED THE IE NEWS AND IT IS HOPED THAT THEY WILL ADD TO THEIR MAILING LIST AT LEAST ONE OFFICER OF EACH OF THE OTHER STUDENT AND SENIOR CHAPTERS. IT IS ALSO HOPED THAT OTHER CHAPTERS HAVING NEWS LETTERS WILL DO LIKEWISE. THIS WILL SUPPLEMENT THE NATIONAL NEWS LETTER AND REDUCE THE AMOUNT OF MEETING MATERIAL THAT IT IS NECESSARY TO PUBLISH THEREIN. THE OKLAHOMA GROUP HAS HAD A GOOD SERIES OF MEETINGS, THAT OF JANUARY 12, 1951 BEING DEVOTED TO THE ELECTION OF NEW OFFICERS. CINCINATTI SENIOR CHAPTER - DANA E. CARWRIGHT, SECRETARY, REPORTS THAT A FINE MEETING WAS HELD ON JANUARY 31ST WHEN THE GROUP MADE A TOUR OF THE PLANT OF THE PHILIP CAREY MFG. AND OBSERVED THE MAKING OF BUILDING MATERIALS. THE FEBRUARY MEETING WAS HELD ON THE 15TH AT THE HOTEL ALMS AND WAS DEVOTED PRIMARILY TO THE TRANSACTION OF NECESSARY CHAPTER BUSINESS SUCH AS THE RATIFICATION OF THE CONSTITUTION AND ARRANGEMENTS FOR AFFILIATION WITH THE CINCINNATI ENGINEERING COUNCIL. TEXA TECH STUDENT CHAPTER - THIS GROUP ALSO PUBLISHES A PAPER CALLED "TIME AND MOTIONS" AND ALTHOUGH NO RECENT COPIES HAVE BEEN RECEIVED WE UNDERSTAND FROM OTHER SORCES THAT THE ORGANIZATION IS CONTINUING TO FLOURISH.

EXECUTIVE COMMITTEE MEETINGS

ON FRIDAY FEBRUARY 16TH THE EXECUTIVE COMMITTEE OF THE NATIONAL ORGANIZATION, WHICH ALSO COMPRISED A QUOROUM OF THE BOARD OF TRUSTEES, MET IN COLUMBUS AT THE HOME OF VICE PRESIDENT JOE MYERS. THOSE PRESENT WERE, PAST PRES. DWIGHT GARDNER, PRES. ROBERT ALLEN, V. PRES. JOE MYERS, TREASURER STEPHEN VEIRS, EXECUTIVE SECRETARY WYLLYS STANTON AND ASSISTANT EXEC. SECY JOE SOUTHERN. THE MOST IMPORTANT PART OF THE MEETING WAS THE ESTABLISHMENT OF A NEW BUDGET. DURING THE EARLY YEARS OF OUR ORGANIZATION IT WAS NECESSARY TO OPERATE ON A VERY MODEST BASIS UNTIL THE REQUIRED NUMBER OF IE'S COULD BE BROUGHT TOGETHER, BUT NOW IT IS EVIDENT THAT THE TIME HAS COME TO STEP UP THE RATE OF ALL ACTIVITIES, AND THAT THE FUNDS NEEDED TO DO SO WILL HAVE TO BE RAISED. THE BUDGET AGREED UPON IS AS FOLLOWS: RENT $420, TELEPHONE $180, SECRETARIAL HELP $2700, MISCELLANEOUS SUPPLIES $600, POSTAGE $500, PRINTING $200, MISCELLANEOUS CONTINGENCIES $200, MAKING A TOTAL FOR HEADQUARTERS OPERATIONS $4800. OTHER ITEMS ARE; NEWS LETTER $1000, JOURNAL $2400, CONVENTION RESERVE $200, AND MEETING EXPENSES $600, MAKING A GRAND TOTAL OF $9000. ALL FIGURES ARE ON AN ANNUAL BASIS.

A COMPLETE REPORT OF RECEIPTS AND EXPENDITURES WILL BE MADE IN A SUBSEQUENT ISSUE OF THE LETTER AFTER THEY HAVE BEEN AUDITED BY A CPA AND INCLUDING MARCH, FOR IT WAS THROUGH LAST MARCH THAT AN OUTSIDE AUDIT WAS MADE. WITH THE PRESENT DAY HIGH COSTS OF LIVING IT IS IMPOSSIBLE TO COUNT ON OPERATING AN ADEQUATE HEADQUARTERS FOR ANYTHING LESS THAN THE AMOUNT PLANNED. PART OF THE POOR COMMUNICATIONS BETWEEN HEADQUARTERS AND THE MEMBERS IN RECENT MONTHS HAVE BEEN DUE TO THE FACT THAT WE HAVE TRIED TO OPERATE ON TOO SMALL A BUDGET. NOTE THAT NOTHING IS INCLUDED FOR PAYMENT FOR THE TIME OF ANY OFFICER, SUCH PROGRESS AS HAS BEEN MADE THUS FAR HAS BEEN DUE TO THE DONATION OF A GREAT DEAL OF EXECUTIVE SERVICE AND THIS WILL PROBABLY CONTINUE TO BE TRUE.

THE OTHER ITEMS PROVIDE FOR ISSUING THE NEWS LETTER APPROXIMATELY TEN TIMES DURING EACH YEAR, (THIS ONE COSTS IN EXCESS OF $100 FOR PUBLICATION, PAPER AND POSTAGE) AND PUBLICATION OF THE JOURNAL FOUR TIMES PER YEAR. THE NEXT ISSUE WILL BE OUT IN MAY AND EDITORIAL MATERIAL SHOULD BE SENT IN AT ONCE. THE REMAINING ITEMS ESTABLISH A CONVENTION RESERVE FUND WHICH WILL BE BUILT UP TO HELP WITH CONVENTION EXPENSES, OR WILL BE AUGMENTED IN THOSE YEARS WHEN A SUCCESSFUL CONVENTION PRODUCES A SURPLUS. THE MEETING EXPENSE BUDGET IS PLANNED TO PUT AN END TO THE PRACTISE OF HAVING OFFICERS AND DIRECTORS GIVE NOT ONLY THEIR TIME, BUT FOOT THEIR OWN EXPENSES FOR ATTENDANCE AT MEETINGS. IT WILL ALSO MAKE IT POSSIBLE FOR SOME MEN TO ATTEND FROM MORE DISTANT POINTS, THERE-BY BROADENING THE AREA OF REPRESENTATION.

IN ORDER TO MEET THE INCREASED BUDGET IT WAS VOTED THAT THE DUES BE INCREASED IN EACH CATEGORY OF MEMBERSHIP TO THE FOLLOWING RATES; STUDENT $2; JUNIOR $5: AND SENIOR $10. EVEN AT THE NEW RATES THE AIIE WILL STILL HAVE ONE OF THE LEAST COSTLY RATE SCHEDULES OF ANY NATIONAL ENGINEERING ORGANIZATION. THE NEW RATES ARE EFFECTIVE ON ALL PAYMENTS DUE ON OR AFTER APRIL 1ST, 1951.

NEW COMMITTEES ESTABLISHED

ANOTHER FEATURE OF THE EXECUTIVE COMMITTEE MEETING WAS THE DECISION TO CREATE A NUMBER OF COMMITTEES FOR SERVICE IN INDUSTRIAL ENGINEERING. THIS IS IN DISTINCTION FROM THE PREVIOUSLY ESTABLISHED COMMITTEES TO SERVICE THE ORGANIZATION. THE OBJECTIVE OF THE NEW COMMITTEES WILL BE TO FORM UNBIASED OPINIONS OF THINGS BEING DONE IN VARIOUS FIELDS OF IE AND TO INFORM OUR MEMBERS, INCLUDING REFERENCES WHEN SUITABLE TO THE WORK OF OTHER SOCIETIES WHO PENETRATE MUCH MORE DEEPLY INTO CERTAIN SPECIALTY AREAS THAN IS POSSIBLE FOR A GENERAL IE GROUP SUCH AS OURS. THE COMMITTEES CONSIDERED SO FAR ARE; ON SYNTHETIC TIMES SYSTEMS; ON INDUSTRIAL SAFETY AND ACCIDENT PREVENTION; ON QUALITY CONTROL; ON PRODUCTION CONTROL SYSTEMS: ON MATERIALS HANDLING SYSTEMS AND COSTS THEREOF; ON APPLICATIONS OF IE TO NEW AND UNUSUAL FIELDS. IT IS RECOGNIZED THAT IN EACH OF THESE AREAS, AND OTHERS THAT MAY COME UP FOR ATTENTION LATER, THERE ARE GROUPS OF PROPONENTS SUCH THAT IT WILL BE A PROBLEM TO OBTAIN A FAIR AND UNBIASED EVALUATION, BUT IT IS BELIEVED THAT IT MAY BE POSSIBLE TO HAVE INTERCHANGES BETWEEN THE PROPONENTS, IN DISCUSSIONS WITH IMPARTIAL PERSONS, PERHAPS UNIVERSITY MEN ACTING AS MODERATORS.

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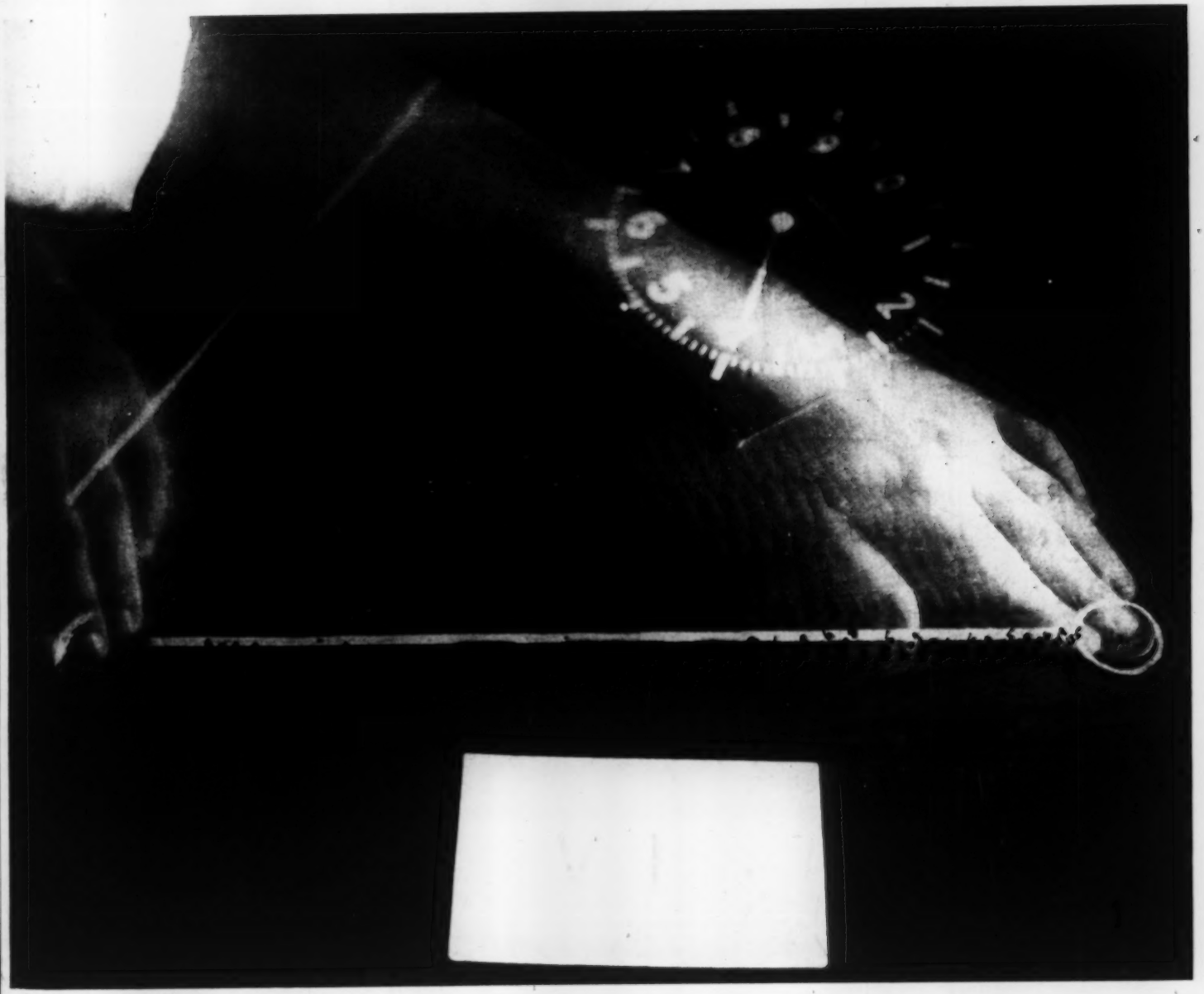

convention issue

may, 1951

AMERICAN INSTITUTE OF INDUSTRIAL ENGINEERS

REGIONS & CHAPTERS

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THE COVER

High-speed stroboscopic photograph used to investigate the characteristics of forearm motion in the Rich Laboratories of Industrial Engineering, Georgia Institute of Technology. This investigation is being performed as a Master of Science in Industrial Engineering thesis by George W. Greenwood.

Notes From The Executive Secretary

It affords great pleasure to report that our Institute has made great progress, although it has been difficult to keep the widely dispersed membership aware of what is being done.

President Allen has appointed a number of new committees, listed elsewhere in this issue. It will be noted that the first seven of these are designed to render service in the field of Industrial Engineering beyond the confines of our society, thus the American Institute enters into the second phase of its operations. When we were first organized our big task was to build a strong group of Industrial Engineers qualified to represent our branch of the engineering profession, this task will, of course, never be finished, and strong efforts will be made to continue progress in this direction.

However, with our new committees we now begin to work on projects for service to the engineering profession, industry which uses the services of Industrial Engineers, and to the public in general.

All members interested in research and writing are urged to participate. Write directly to the chairman concerned with the field of your interest or to national headquarters.

Wyllys G. Stanton

A Word From The Convention Chairman

Dear Fellow Members:

Just a note to all of you to let you know that the convention committee members have not entirely worked themselves to death — they're still kicking. Your committee has worked very hard to make this Second Annual Convention a source of professional enrichment as well as relaxation and good fellowship. The nicest way in which our members can thank us for our efforts is by attending the convention and by bringing their wives or girlfriends (don't bring both!)

One of the more serious difficulties in planning such an affair is the necessity of making definite commitments with Hotel Statler as to room size and meals contracted for. Please make our job a little easier by sending your registrations in early.

Let's all be looking forward to winding up a busy year by having a fruitful, pleasant and memorable convention! I'm looking forward to shaking hands with all of you on June 16.

K. T. Korn

SHOULD WE REPLACE THIS MACHINE?

. . . by Frank M. Gryna, Jr. Instructor of Industrial Engineering, New York University

Mike Feeney, foreman of the turret lathe department, informs us that turret lathe #21 is wearing out and requests that it be replaced.

What facts should management consider in deciding whether or not to replace the lathe? What are the elements of a machine replacement study? Our analysis can be divided into two parts—first, a study of costs and second, a consideration of the intangibles (any relevant facts in monetary units).

Considering cost, what calculations should we make to compare the cost if the present machine is retained to the cost if a new machine is purchased? The simplest method is to compare the annual cost if we keep the present unit to the annual cost if we buy a new machine. The annual cost of a machine is composed of two parts:

1. The annual cost of recovering the investment in the machine. (We shall call this the Annual Cost of Capital Recovery or A.C.C.R.)
2. The annual operating cost consisting of labor, repairs, power, supplies, space etc.

First, then, we must calculate the Annual Cost of Capital Recovery. In doing this, we will include an interest rate (i.e. a rate of return. Why is an interest rate included in the calculations? Suppose we had to borrow the money to pay for the first cost of the proposed new machine. Here, we will agree that interest should be recognized in the calculations because we must pay interest on the borrowed money. However, even if it is not necessary to borrow the money, we should still consider interest in the calculations. If the new machine is not purchased, we have the opportunity of securing a return (interest). The dollars representing the first cost of the new machine could be invested in a safe security and eventually yield a return of 1% interest. By purchasing the new machine, we are giving up the opportunity of investing the money and earning a return. Therefore, even though the money is not borrowed, interest is a cost and should be included in the Annual Cost of Capital Recovery.

The Annual Cost of Capital Recovery can be calculated from the following formula:

$$A.C.C.R. = (P-L)\ (CRF)\ in + L\ (i)$$

where: P = First cost (including installation)

L = Salvage value at the end of n years

(CRF) in = Capital Recovery Factor for n years of life and i% interest

n = Capital Recovery period

i = Interest rate (in decimal form)

The Capital Recovery Factor for various values of n and i can be found on the Chart for Capital Recovery Factor.

The following example will illustrate the calculations for comparing a present machine to a proposed machine on the basis of annual cost. We are considering the replacement of turret lathe #21 and have estimated the costs of a new machine as follows:

First cost = $20,000
Expected life = 10 years
Salvage value at end of life = $5,000
Annual operating costs:
Labor = $3,000
Repairs = $150
Supplies = $50
Power = $200
Taxes, insurance, space etc. = $100

It has been decided that we could earn 6% interest if we invested the money in a security instead of buying the new machine. From the chart, the CRF for 10 years and 6% is 0.135. Then:

A.C.C.R. = (20,000 - 5,000) (0.135) + 5,000 (0.06) = 2,325
Annual operating costs = 3,000 + 150 + 50 + 200 + 100 = 3,500
Annual Cost = 5,825

An annual cost of $5,825 will be incurred if we buy a new machine. We must compare this to the annual cost if we keep the present machine in operation.

The cost data for the existing machine is as follows:

Original cost = $12,000
Expected total life = 10 years
Salvage value at end of total life = 0
Estimated life remaining = 2 years
Present salvage value = $3,000
Annual operating costs (for the remaining life)
Labor = $3,700
Repairs = $250
Supplies = $75
Power = $250
Taxes, insurance, space etc. = $200

First, we will compute the A.C.C.R. if we keep the existing machine. For the existing machine, the Annual Cost of Capital Recovery is computed on the present salvage value and the remaining life instead of on the original cost and the original total expected life. This viewpoint is logical because interest charges are calculated only on money which becomes unavailable by the adoption of one of the alternatives. If we keep the present lathe, we forego the opportunity of collecting the present salvage value ($3,000) and investing it somewhere to secure a return. We do not give up the chance of investing the original cost ($12,000) because we cannot collect this amount today and invest it. The present salvage value is all we can realize today for investment purposes. For this reason, the A.C.C.R. for the present lathe should be based on the present salvage value and the remaining life.

From the chart, the CRF for 2 years and 6% is 0.54.

6% is 0.54. Then:

A.C.C.R. = (3,000 - 0) (0.54) + 0 (0.06) = 1,620
Annual operating costs = 3,700 + 250 + 75 + 250 + 200 = 4,475
Annual Cost = 6,095

If the existing machine is retained, the annual cost will be $6,095. With a new machine, the annual cost will be $5,825. Therefore, a saving of $270 per year will be realized if the new lathe is purchased.

The Intangible Analysis

So far, we have compared the present machine with a new machine from a cost angle only. In addition to cost, there are other elements to consider which we cannot state in monetary units. Some or all of the following elements may have an important bearing in a machine replacement study.

1. *Quality of production.* Is the quality of the finished product from the old machine comparable to that of a new machine? Often, a superior product from a new machine may be absolutely necessary to obtain a

high sales volume. In addition, a new machine may result in less spoilage — a definite cost of production.

2. *Availability of funds.* Do we have enough money available to purchase a new machine? If funds are available, we must be sure that sufficient working capital remains after the expenditure is made. If we must borrow the money, we must consider the consequences of a failure to pay back the loan.

3. *Recovery of investment.* The length of time which we allow ourselves to recover the investment in a machine is known as the capital recovery period. In some types of machines, greatly improved models are developed every few years. If we purchase a machine today and three years from now a radically improved model is introduced, competition may force us to purchase the new model. If eight years was originally allowed to recover the investment, (capital recovery period=8 years), not all of the investment in the original model would have been recovered. If an improved model is imminent, use a short capital recovery period in the calculations. In any event, try to check the possibility of an improved model in the near future.

4. *Product demand.* It is hoped that the present demand for our product will continue in the future. But suppose our competitors develop an improved product which requires different machinery. Competition may force us to buy the new equipment necessary to manufacture the improved product. Here again, we must be careful in selecting the capital recovery period. Logically, the capital recovery period should be equal to the expected life of the machine. However, if there is a chance that the product demand may soon collapse, it may be wise to use a short capital recovery period.

5. *Capacity required.* Would it be worthwhile to purchase new equipment with a greater capacity than is presently required? If a greater capacity will be needed soon in the future, it may be more economical to purchase one large machine now rather than add supplementary units in the future. Furthermore, the ability to produce large quantities in a short time may be a deciding factor in securing customers.

6. *Labor displacement.* If a new machine is purchased, will it displace any worker from their jobs If the need for a worker is eliminated by a new machine, another job must be found for the displaced worker.

7. *Machine flexibility.* Consider the existing machine and the new machine from the standpoint of doing different types of work. If the sales of product from a machine suddenly collapses, the machine must be capable of manufacturing a part which is in demand. Otherwise, we incur the cost of an idle machine.

8. *Machine breakdown.* If a machine breaks down in operation, an entire production line may be disrupted. A breakdown in an old machine may result in more time, expense and inconvenience than a breakdown in a new machine. Investigate the old and new machines to check for any difference in the effect of a breakdown.

9. *Safety.* Improved safety features on a new machine should be considered not only for worker protection but also for lower insurance charges.

10. *Work in process inventory.* Many new machines result in a saving in direct labor time. This saving can be indicated in the previous cost calculations. In addition, however, a saving in the direct labor time will result in a faster flow of product through the plant. In job shop work, the faster flow of product can help reduce the work in process inventory.

Too many companies use guesswork to decide whether or not to replace a machine. Until recently, industry has ignored any systematic approach towards machine replacement. Systematic procedures have been taught in the universities for many years. Systematic procedures are available — it's up to industry to use them.

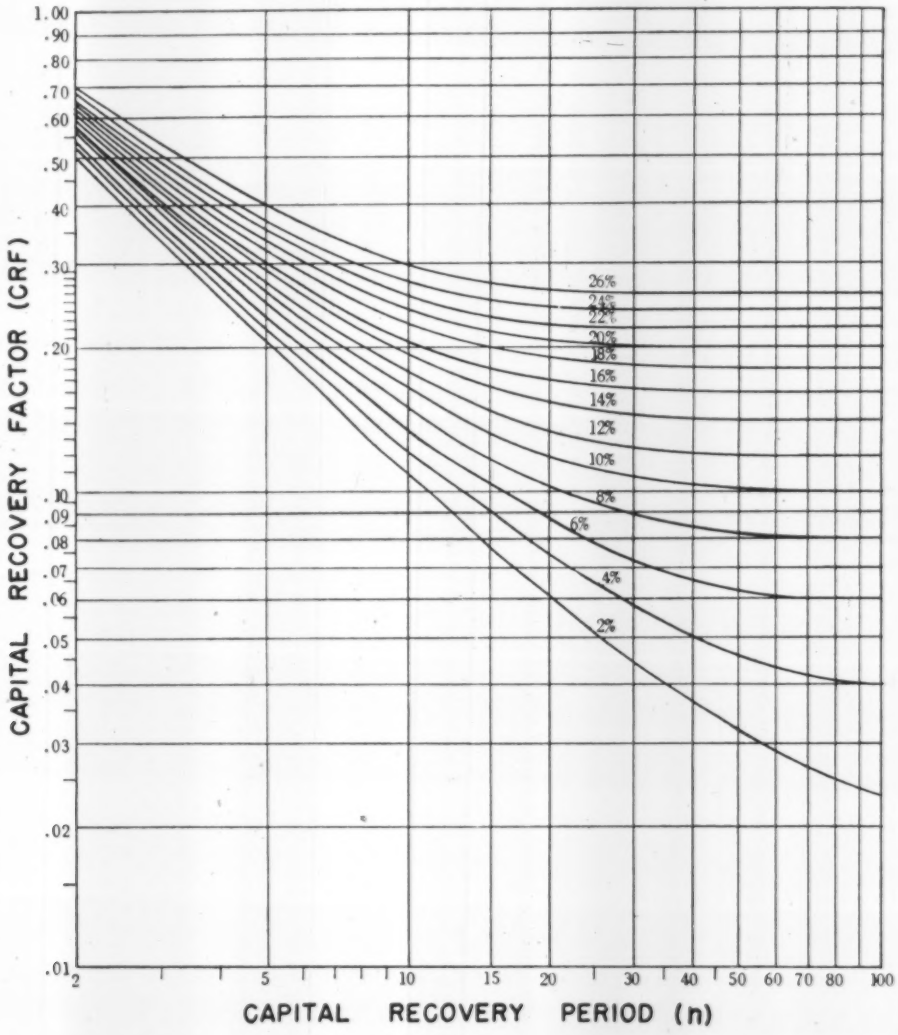

Chart for Capital Recovery Factor

"Human Engineering"
The Hallmark of Our Incentive Plan

. . . by Raymond K. Hovel

Chief Industrial Engineer, Dilts Machine Works, Division of Black-Clawson Company, Inc., Fulton, N. Y.

Mr. Hovel has engineered several wage incentive plan installations in the plants of Black-Clawson Company, Inc., the latest of which is described in this article. He has just been promoted from the position of Chief Industrial Engineer to that of Works Manager. He firmly believes, as is evidenced by this article, that "human engineering" is the master key to successful industrial engineering. This article presents a comprehensive account of the basic steps and fundamental principles involved in the installation and administration of a successful, human engineered incentive program—an actual case history showing the importance of management-labor team work.

The Dilts Machine Works — with a shop personnel of about 170 employees —is an extremely specialized plant manufacturing paper-mill converting equipment of all types. Except for a few standardized machines developed in earlier years, the company could more accurately be described as selling engineering knowledge — each customer's particular situation requiring specially built equipment. For this reason most of its productive work occurs in small quantity runs and great variety of parts — two serious obstacles to the successful application of incentives. Despite such odds and guided by a twelve year favorable incentive experience at another Black-Clawson division — Shartle Brothers Machine Company of Middletown, Ohio — the Dilts management decided in March, 1949 to try incentives. Their effectiveness has been amply proved during the past two years and has given rise to a single regret — that the decision to install an incentive plan was not made several years earlier.

The success of such a plan is not accidental. It must be purchased at the price of fair and impartial treatment of the workers, intelligent and accurate measurement of the work, and eternal vigilance against inequities of any sort brought about by careless administration. At the Dilts Machine Works incentives have resulted in a saving of 37½ per cent on all productive work, greater volume of business, better satisfied employees, greater accuracy in costs, and a greater consciousness of methods in manufacturing operations. With no limitation on incentive pay, shop-wide direct-labor premium earnings have averaged 20-22%; indirect labor 10-11%.

Preliminary Steps

Before the company's intentions were formally announced to the shop personnel, a few preliminary preparations were made by the industrial engineer engaged to carry on the project. One of these was in the form of a dual survey:

First, into the shop to observe at first hand the types of work performed, the general condition of the equipment, and the general shop practices in tooling and methods. Second, by a careful examination of the company's records to ascertain (a) the ratio of productive to non-productive personnel, (b) the activity of the company's major products, (c) the completeness and accuracy of the cost records of past performance, (d) the existing shop wage structure, and (e) the company's organizational structure and policies.

A 50-50 ratio between the productive and non-productive personnel was found to exist at the Dilts plant. This is an unfavorable ratio and it gave rise to two possible problems: the lack of participation in direct incentives of a majority group, and a top-heavy expense to be borne by measured work alone. Plans were made at once to improve the 50-50 ratio through the training and up-grading of non-productive personnel to productive jobs.

The record of activity of the companys' major products assisted the industrial engineer in determining the approximate number of time-study personnel that would probably be required to maintain adequate direct-incentive coverage.

Complete and accurate cost records of past performance were found to exist — a convenient tool in checking the incentive performance on individual operations and a reliable means for measuring the overall effectiveness of the incentive program.

The existing shop wage structure was examined in the interest of good personnel relations. The base rates were found to be consistent with the prevailing rates in comparative industries in this area. It is essential that incentive pay be used strictly as a reward for more-than-average effort, not as a loose differential to "build up" inadequate rates.

An acquaintance with the company's organizational structure and policies enabled the industrial engineer (1) to determine the proper channels through which to carry on his work and (2) to establish incentive policies consistent with the company's basic policies.

Another preparation was in the form of a series of meetings with the supervisory personnel. *This is an extremely important step in the installation of this kind of incentive program.* As number one man of the department, it is the foreman who is called upon to help "sell" the incentive philosophy to the workers, engineer manufacturing methods, instruct the workers in those methods, and help the company to obtain fair and accurate measurement of the work. With this in mind the Dilts foremen were thoroughly schooled in the mechanical details of the particular incentive system to be used and more especially in the difficulties and pitfalls sometimes encountered in such a project: resistance on the part of an employee who may have had an unpleasant incentive experience in the past; favoritism in the assignment of incentive work during the early stages of the installation; failure of the company to stand by incentive time values unless there is a definite change in method; lack of supervisory interest or attention to tooling, methods, general working conditions, or instruction of the workers with resultant unbalanced or inconsistent time values; and failure of the company to provide for incentive participation by a majority group and then to compensate proportionately those individuals who cannot practicably participate. This method of "selling" the foremen resulted in a pledge of 100% co-operation on their part to make the incentive program a success. It was further revealed to the foremen that they were to be included in indirect incentive earnings as a reward for their efforts and responsibilities in connection with incentives.

As a final preliminary step the industrial engineer prepared written description of the particular incentive system to be used at Dilts. This was for the purpose of furnishing each individual participating in the plan a simple but com-

prehensive explanation of all its essential phases: the importance and authoritative role of the foremen as methods engineer; the various methods of obtaining incentive coverage; the general categories of work included in direct and indirect incentives; the calculation of incentive earnings along with method of payment; and a few items of basic company policy, such as "no limitation on direct incentive earnings", "no cutting of a time value officially established for a given method", and "all questions concerning incentives to be brought to the attention of the foreman".

When these preliminary steps were completed an informal meeting was held with the entire shop personnel. The meeting had two important purposes:

1. to announce the company's plans for incentives
2. to introduce the industrial engineer

Pulling no punches the works manager described the company's urgent need for cost-reduction in the face of serious competition. One or two examples of attractive jobs recently "lost" served as graphic illustration of this point. He continued by expressing — on behalf of top management — the firm belief that wage incentives were one effective answer to the problem, and that a co-operative project of this sort would result not only in greater take-home pay for the employees but also in greater job security due to increased volume of business. A few words of background then served to introduce the industrial engineer who proceeded to outline the basic elements of the proposed incentive system. He was particularly careful to mention the difficulties encountered in the application of incentives to this type of highly variable work — the difficulties of coverage, methods standardization, and adequate tooling — but expressed the conviction *based on experience* that such difficulties could be largely overcome by real team work and faith. At the conclusion of a healthy, informal discussion by the group, a copy of the written description of the incentive system was given to every shop employee.

Secondary Steps

Two further steps of major importance were now taken to get the project under way.

The first was to build up a time study staff. This was done by "inviting in" three men from the shop — a skilled machinist, a foreman, and an assembler. These particular men were chosen because they possessed two important qualities:

1. a well-rounded shop knowledge
2. a reputation for honesty, fair play and good judgment

The three shop men were taught the techniques of time and motion study partly through an accelerated training course given them by the industrial engineer, partly by "on the job" training. If a wage-incentive plan is to succeed, the time study personnel must be "accepted" in the shop and must have the necessary know-how to obtain fair and accurate measurement of the work. At Dilts the fairness of the allowed time values and the complete impartiality shown the workers have enabled the time study men to "do a job" and yet be accepted as "part of the gang".

The second important step at this point was the acquisition of certain basic shop data: the machining properties of the particular grades of cast iron, steel and other materials used in the Dilts products; the capacities and limitations of the company's machine tools; tables of economical and practicable speeds and feeds; a set of standard shop practices in relation to the number of permissible cuts and amount of stock removal; and fundamental methods for general fabricating and assembly work. This information was obtained through means of experiments and tests conducted jointly by the foremen, tool department and time study department. Such data have several useful purposes:

1. As a measuring stick they enable the time study staff to evaluate work performance on a completed time study and maintain proper consistency in the time values.
2. They make possible the derivation of machine formulas and special standard data applicable to a particular line of work or set of conditions.
3. They serve as an important tool in the estimating of labor on new work for the purpose of competitive bidding.
4. They are an aid to the foreman in his important job of helping develop proper methods and then instructing the workers in the use of those methods.

Description of the Direct Plan

The Dilts incentive system is composed of two plans: the Direct and the Indirect.

The Direct Plan is one under which individual jobs are measured and individual incentive is paid to a single employee or small group. Measurement is made by time study, adaptation, and formula application. Time study alone would be far too slow and laborious in a highly specialized plant such as Dilts, but adaptation and formula application make rapid strides possible. The success of all three processes is dependent upon the consistent use of intelligent methods. And these at Dilts are principally the responsibility of the foreman. When an unfamiliar type of operation is to be covered, the operation is first analyzed by the foreman — with the assistance, if necessary, of the tooling department, general shop supervision, or time study staff. An attempt is made to determine the best conceivable method for performing the operation — the proper tooling and correct speeds, feeds and stock removal for a machining operation; the correct tooling and sequence of sub-assemblies in assembly work; and the proper holding fixtures, welding rods and weld requirements in fabrication work. *If this all-important methods engineering is not done by the company through its foremen, it will be done by the employees themselves. And that leads to loose values and inconsistencies.* After the proper method has been determined, the new operation or process is time-studied. Abnormalities are segregated as foreign elements and are adequately compensated for, along with fatigue, by a 15% allowance on *manual elements.* In addition a leveling factor is used to raise or lower the actual time spent on those manual elements to a day work pace. This factor is determined by the time study observer according to his judgment of the degree of skill and effort demonstrated by the worker during the study. The thought is constantly stressed at Dilts that good faith and co-operation during a time study pays off much better than the hold-back attitude. Examples are given to show how good skill and effort actually result in higher time allowances than does mediocre performance. An allowance of 20% or more is applied to *machine-controlled elements* after these have been properly engineered by the foreman in keeping with the basic data. Without this allowance the incentive earning possibility would be greatly reduced and the incentive program would have little chance for survival. The final step in the completion of the time study is the recording of all pertinent information on the back of the time study form. The particular form used is one developed by the Methods Engineering Council of Pittsburgh.

It the operation to be measured is similar to an operation previously analyzed and standardized in the above manner, the adaptation procedure may be used for the measurement. This involves the direct use of any directly applicable elements of the original study and the calculation by proportion or other means of any elements which are different. Adaptation, along with formula application, not only saves time but also promotes greater consistency in the allowed time values for similar operations.

Formula application is the establishment of allowed time values through the use of standard data or mathematical formulas. This has been an extremely

useful tool at Dilts in the difficult job of coverage. The formulas were developed from time studies made at the Dilts plant. In this manner they are directly applicable to the Dilts line of work and are consistent with the prevailing conditions. A few good "universal" formulas can be found in text-books, but they usually apply to standard machine tools and ideal conditions neither of which is characteristic of the typical specialized machine shop. Each formula consists principally of two parts:

1. A group of constant time values which remain the same for similar types of manual work performed under similar conditions.
2. A group of variable time values which change with each new set of conditions.

The formula may be used "at the desk" or "on the spot" depending upon the complexity of the operation. No formula is accepted for general use until it has been thoroughly tested on a variety of operations and found to provide fair and accurate time values.

Through the use of the three methods of coverage above described, the Dilts time study staff has maintained from 70 to 85 per cent incentive coverage on the operations of five departments: machine shop, assembly department, welding shop, bar and heat-treating department, and carpenter shop. An average of 700 operational time values are established per month on a broad variety of work.

Some of the Problems

The Dilts Direct Incentive Plan has not been entirely free from an occasional difficulty or problem. Occasionally a loose time value "creeps in" due to inadequate methods engineering. To date such situations have been corrected, first, by pointing out to the employees affected the unfairness of such values to the other employees, and, second, by getting their consent to have the operation restudied. The company's own good faith in "standing behind" properly established time values is unquestionably the reason for this sportsmanlike attitude. Any question that arises concerning a time value, an error in incentive pay, or any other phase of the program is handled by the foreman. He personally obtains a satisfactory explanation or correction of the situation and conveys the necessary message to the employee involved. In this manner the foreman has remained number one man of his department at Dilts and is respected as such by his workers. Carless work is subjected to a mild but effective penalty — the loss of premium earnings on the parts involved. Contrary to the oft-made assertion that incentives produce high scrap records, the amount of time involved at Dilts in bad work and its correction or replacement has rarely exceeded 3% of the total direct labor hours spent during any given week — a further indication of the fairness of the time values. During its first two years of existence the Dilts incentive program has had not a single major complaint.

Direct premium pay is computed and paid weekly as a part of the employee's weekly earnings. Due to the simplicity of this particular incentive system — a variation of the standard-hour plan — an employee can keep an accurate daily record of his premium earnings.

The Indirect Plan

In order to make incentive participation available to all shop employees, Dilts inaugurated the Indirect Plan within five months after the begining of the Direct. The Indirect Plan applies to work which is not measurable on a direct basis. Some of the jobs included in this category are: tool-making, tool-grinding, maintenance, stock handling, crane operating, crane following, shipping, sweeping, and yard work. At Dilts indirect incentives have shown their effectiveness in terms of increased interest and co-operation on the part of the indirect employees. Indirect premium pay, computed once a month, was arbitrarily set at one-half the average direct premium percentage earned on all direct premium work during the month. It is thus of advantage to the non-productive workers to help raise the percentage of direct premium earnings.. The Indirect Plan is also extended to the shop supervisory group and to the portion of measurable work not yet covered. It is felt that this fair treatment has amply paid off in the good will that prevails at this company.

Some of the Benefits

Two major benefits had been predicted for the employees — greater take-home pay and greater job security due to increased volume of business. The company proved right on both counts. The Dilts employee's earnings are high among comparative industries, and the company's strengthened competitive position has helped it to obtain certain jobs that would otherwise have been "lost". Accurate cost comparisons made during the first year of incentive operation revealed a saving of 37½ per cent on all direct labor. This means that a year and a half of productive work was shrunk into one year, with a parallel saving of a portion of the non-productive labor. To date the records indicate a saving of approximately 90,000 man-hours of labor. In addition, the company's costs are much more uniform, delivery schedules are being met, and foremen and operators alike have become methods-conscious. Finally, the employees and supervisors alike, look up to and respect *their* incentive plan.

Alpha Pi Mu

THE NATIONAL INDUSTRIAL ENGINEERING HONOR FRATERNITY

. . . by Jay Klein

Alpha Pi Mu, the national industrial engineering honor fraternity, confers membership upon those students who have shown exceptional academic interests and abilities in the field of industrial engineering. The fraternity was founded at Georgia Tech., January 25, 1949, and has had a remarkable growth, until it now has chapters at Ohio State, The University of Alabama, Virginia Polytech, New York University, Washington University, Oklahoma A and M, and Columbia. Many other colleges and universities have applied for charters, and indications are that this growth will continue until there are chapters of the fraternity at the majority of schools offering courses in industrial engineering.

Until recently, there was little need of an honor fraternity of this type; the industrial engineering profession was comparatively new, and few schools offered a degree in this field. Now, however, industrial engineering has found its place in the engineering profession, and a formal training is more necessary now, than formerly, to met industry's demand for well schooled engineers of high leadership ability. The adoption of a standard curricula called for an agency to recognize superior performance and confer commensurate honor. Accordingly, Alpha Pi Mu was founded to further the interests of industrial engineering, to create a closer student faculty relationship by bringing together the needs and thoughts of both and to confer recognition upon the student of industrial engineering who has shown exceptional interest and ability in his field.

The badge of the organization is a gold key, which consists of a triangle superimposed upon a cog wheel. On each leg of the triangle is one of the letters Alpha, Pi or Mu. The undergraduate or alumni who wears this key has shown excellence of scholarship, leadership, character, ethicality and sociability as well as breadth of interest. Membership is not confined to the student alone, however, for the charter makes provision for honorary initiation of those men who have made outstanding contributions to the field of industrial engineering.

Second Annual Convention

The Cleveland Chapter has been selected as host of the Second Annual Convention of the American Institute of Industrial Engineers, Incorporated. The convention will be held at the Hotel Statler, Saturday, June 16, 1951, in the Ohio Room on the mezzanine.

The following program has been planned for the convention. Please note that Cleveland is on Eastern Daylight Saving Time.

PROGRAM

For

SECOND ANNUAL CONVENTION

Morning

8:30-9:30 Registration
9:30 Chairman's recognition of Chapters
10:00 Developments on Industrial Engineering
12:00 Luncheon
Speaker — Ewan Clague, Commissioner, Bureau of Labor Statistics, U. S. Department of Labor, Washington, D. C.
Subject — "Productivity, Here and Abroad"

Afternoon

2:00 Business Session
Agenda
Read minutes, last convention
Old business
Treasurer's report
Standing Committee's Reports
President's Report
Tellers' Report on Election
Installation of officers
New Business
Adjournment
4:00 Committee Meetings
6:30 Banquet, Fellowship awards, music and dancing

A program is being planned for the ladies for the afternoon. Ladies will join the meeting at 6:30.

THE COMMITTEE

General Chairman —
K. T. Korn — *Edward A. Berk & Associates*
Vice Chairman —
J. F. Shuri — *Ohio Rubber Company*
Program —
M. C. Miller — *Republic Steel*
Louis Ufholz—*American Greeting Publishers, Inc.*
Technical Papers —
L. R. Grimes — *Ohio Rubber Company*
Publicity —
Joseph Terr — *Consulting Engineer*
Registration —
George J. Fisher — *Republic Steel Corporation*
Ladies' Program —
Mrs. K. T. Korn

THE SPEAKER

We were fortunate in securing Commissioner Ewan Clague, head of the Bureau of Labor Statistics. Commissioner Clague is a well-known public speaker and also thoroughly familiar with the timely subject on which he will talk. Under his direction, his bureau has conducted very extensive studies on productivity in this country and particularly in the Western European countries. The studies have been in progress since 1946 and will form much of the factual and statistical foundation of Commissioner Clague's discussion.

THE LADIES' PROGRAM

The national executive board and your convention committee were unanimous in their desire to have at least part of the convention with our ladies. All too often we let our technical and professional interests dominate the AIIE meetings and events and it is our belief that at least once a year we would like to drop the serious aspects of industrial engineering and make room for good fellowship, and some relaxation. We have therefore asked Gladys Korn to plan a program for the ladies for the afternoon, so that our wives and girlfriends will not be bored or forgotten. They will join us around 5:30 about which time we expect to adjourn our closed session.

THE ENTERTAINMENT

Starting at 6:30 we shall have music. Arrangements are being made by Clint Noble, famous entertainer and entertainment director.

THE COST

To defray the expenses of the convention a registration fee of twelve dollars ($12) will be charged to members. The fee will include all expenses inclusive of luncheon and banquet. For the ladies there will be a charge of five dollars ($5) to cover expenses of the banquet.

REGISTRATIONS

You are requested to register early. Registrations should be mailed in advance to:

GEORGE J. FISHER
369 Station D, 5610 Hamlet Avenue,
Cleveland, 27, Ohio

Please inclose your check for $12 for the men and $5 for the ladies.

HOTEL ROOMS

The Statler Hotel has set aside a block of rooms to accommodate out of town members. Please make your reservations directly with the hotel by writing to:

MR. J. L. WATSON, Front Office Manager
Hotel Statler, Cleveland, Ohio

stating type of accommodation desired, date and approximate time of arrival and checkout. Please state that you are an AIIE member to insure proper accommodations and handling.

CONSTITUTION – AMERICAN INS

ARTICLE I — NAME

Section 1 — The name of this organization shall be the American Institute of Industrial Engineers, Hereinafter called the AIIE.

Section 2 — Each local Unit of the AIIE shall be known as a chapter and shall be called by the name of the city or county in which it is located followed by the words "Chapter of AIIE".

Section 3 — Where chapters of the AIIE are non-existent, each member shall be known as a member of the AIIE and shall be afforded the same rights and privileges as any other person belonging to the organization.

ARTICLE II — PURPOSE

The purpose of this Organization shall be:

1. To maintain the practice of industrial engineering on a professional status.
2. To foster a high degree of integrity among the members of the industrial engineering profession.
3. To encourage and assist education and research in areas of interest to the industrial engineer.
4. To promote the interchange of ideas and information among members of the industrial engineering profession.
5. To serve in the public interest by the identification of men qualified to practice as industrial engineers.

ARTICLE III — CODE OF ETHICS

The code of ethics of the AIIE shall be the Canons of Ethics of the National Society of Professional Engineers.

ARTICLE IV — MEMBERSHIP

Section 1 — There shall be four classes of membership:

A — Student
B — Junior
C — Active
D — Fellow

Only fellows, active, and junior members shall be entitled to vote and hold office.

Section 2 — A. Student members shall be regularly enrolled students of accredited curricula in industrial engineering. Student members may transfer to junior membership upon graduation.

B. Junior members shall be engineers-in-training engaged in industrial engineering work or graduates of engineering curricula accredited by the ECPD and engaged in industrial engineering practice. Junior members may transfer to active membership upon receipt of their professional license or upon the attainment of five years of professional industrial engineering experience.

C. Active members shall be state licensed professional engineers engaged in industrial engineering practice or other persons who can present proof of long experience in industrial engineering practice.

D. Fellows shall consist of a small group of outstanding leaders in the profession, who are to be honored by being elected to this grade of membership. Fellows must have given at least 15 years of service to the industrial engineering profession and shall be selected by the executive council and approved by the National Convention. Not more than five percent of the total membership is to be admitted to this group during any one year, the total number never to exceed ten percent of the membership. The start of this group is left to the discretion of the Board of Trustees.

Section 3 — Any member may withdraw from the AIIE any time by sending a formal statement to that effect to the executive secretary. In event of withdrawal any refund of unexpended dues will be waived.

Section 4 — Any member neglecting to renew his membership by the payment of dues is to be carried on the rolls for an additional 45 days, during which time he is to receive a notification from the executive secretary that his membership has lapsed. If his dues have not been received at the end of this period the member's name shall be dropped from the rolls. Any member so dropped can rejoin the AIIE by sending in a new application.

ARTICLE V — ELECTION OF MEMBERS

Section 1 — Persons who wish to join the AIIE and who feel that they have the required qualifications shall apply by filing an authorized application blank, obtainable from the national office, with the executive secretary.

Section 2 — After reviewing the applicant's qualifications, the membership committee will confer or withhold membership in the AIIE subject to the approval of the Board of Trustees. The membership committee shall consist of three members appointed by the president with the approval of the Board of Trustees.

ARTICLE VI — CHAPTERS

Section 1 — There shall be two classes of chapters, namely active and student.

Section 2 — Active chapters shall consist of ten or more regular members (fellows, active, or junior) of the AIIE who have been granted a charter upon application to the Board of Trustees.

Section 3 — Student chapters shall consist of ten or more student members of the AIIE who have been granted a charter upon application to the Board of Trustees.

Section 4 — Each student chapter at the beginning of each school year, shall appoint an advisor from the faculty of their university. This advisor, who shall be known as the honorary chairman, shall be a regular member of the AIIE. No advisor shall serve for more than two consecutive years.

ARTICLE VII — ORGANIZATION

Section 1 — The National organization of the AIIE shall consist of an association of all the members, divided into regions, as specified by the execu-

tive committee.

Section 2 — The legislative body of the AIIE shall be the national convention and shall consist of the national officers, delegates from the various active chapters, and one delegate-at-large from each region for every 100 members or fraction thereof. The delegate-at-large, who will represent the members who are not affiliated with chapters, shall be appointed by the vice-president of the region no less than 30 days before the meeting of the national convention. Each chapter shall be entitled to send one voting delegate. The national convention shall meet every year at such time and place as shall have been determined by the Board of Trustees.

Section 3 — The national officers of the AIIE shall be as follows: President, Executive Secretary, Assistant Executive Secretary; Treasurer, two board members-at-large, and one vice-president from each region who shall serve as deputy of that region. *These officers shall constitute the board of Trustees of the AIIE.* All officers except the Board members-at-large shall have terms of office of one year. The board member-at-large shall serve two years. The officers shall carry such duties as are customarily connected with their offices and such additional duties as may be assigned to them by the national convention.

Section 4 — A slate of officers, excluding the vice-president, for the AIIE shall be drawn up yearly by a nominating committee consisting of the vice-presidents. At least two and not more than three names shall be put up for each office.

fice. Officers shall be elected by a mail vote of the entire regular membership, the ballots being distributed and counted by the executive secretary. Until such time as there are at least three vice-presidents, the board of trustees shall constitute the nominating committee.

Section 5 — The vice-president for each region shall be elected at the same time as the remaining national officers by the entire regular membership of the region in which he is to serve. At least two and not more than three names for this office shall be drawn up by a nominating committee consisting of the chapter chairmen and the delegate-at-large from the region. The nominating committee will count the ballots. The retiring vice-president will be responsible for the preparation and execution of the election.

Section 6 — *The president, executive secretary, assistant executive secretary, treasurer, and retiring president shall constitute the executive committee,* and shall have the duties and powers delegated to it by the Board of Trustees.

Section 7 — Vacancies in the Board of Trustees which may occur in the interim between elections shall be filled by that board. Members so elected shall serve until the next election when the remainder of the term shall be filled by action of the regular membership.

Section 8 — The Board of Trustees shall exercise powers of the National Convention in the interim between conventions subject to such restrictions as may be imposed by any convention and to the provisions of this constitution.

Section 9 — The organization, time of meetings, committees, etc. of the Board of Trustees and the Executive committee shall be left to the discretion of these two bodies respectively, provided that nothing in this section is construed as conflicting with any other section of this constitution.

Section 10 — The vice-presidents shall supervise the chapters in their respective regions and shall arrange for regional conferences as stated in the by-laws.

Section 11 — The assistant executive secretary shall assist the executive secretary and have additional duties as may be delegated to him by the Board of Trustees.

Section 12 — A quorum for the National Convention shall consist of those present. A quorum for the Board of Trustees shall consist of two-thirds of its membership.

Section 13 — The executive secretary, at the close of each fiscal year, shall draw up a budget for the coming year to be presented to the Board of Trustees for approval.

Section 14 — Any necessary action pertinent to the proper functioning of the financial status of the AIIE shall be taken by the Board of Trustees.

Section 15 — The National Convention, upon recommendation of the Board of Trustees, may provide for financial compensation to any officers or employees of the AIIE.

ARTICLE VIII — LOCAL POWERS

Section 1 — Each chapter shall have complete control of all matters of local concern under such restrictions as may be imposed by this constitution, the by-laws, or the national convention. In no case shall such powers be exercised contrary to the ideals and purpose of the AIIE.

Section 2 — Each chapter shall be required to submit to the Board of Trustees for its approval its constitution, by-laws, and any amendments which may be enacted from time to time.

Section 3 — The officers of each chapter shall be the chairman, vice-chairman, secretary, and treasurer. When desired, the two latter officers may be combined. All officers of the chapter shall be elected at some convenient time subject to the provisions of the chapter's constitution and by-laws.

ARTICLE IX — SUSPENSION AND EXCLUSION

Section 1 — Any member convicted by the chapter to which he belongs of conduct unbecoming to a gentleman and to a member of his profession shall be dismissed and deprived of his membership. The justified withdrawal of an engineer's state license might be construed as a case to apply in this article. Such exclusion requires

a three-fourth vote of all of the members of the chapter in which the proceedings were initiated and shall be reviewed by the Board of Trustees before it becomes effective.

Section 2 — The Board of Trustees may expel for cause, any unaffiliated member of the AIIE, provided this member is given the opportunity to answer the charges pending against him before final action is taken.

Section 3 — The National Convention shall have the power, by a three-fourth vote, to withdraw or suspend the charter of any chapter for cause upon the recommendation of the Board of Trustees, provided that the delinquent chapter shall have been given due notice that such action will be recommended. This notice shall be accompanied by a statement of the charges pending against the chapter and the chapter shall be given the opportunity to reply to these charges before final action by the convention.

ARTICLE X — SPECIAL CONCESSIONS

Section 1 — The Board of Trustees, upon careful consideration and by unanimous consent of all board members, may grant a chapter exemption on from rules and regulations passed for the AIIE as a whole for a limited time. This grant shall be revoked when the existing conditions no longer warrant this consideration.

Section 2 — The Board of Trustees shall be empowered to call special meetings of the National Convention whenever existing conditions warrant such an action.

ARTICLE XI — BY-LAWS

The Board of Trustees, by a three-fourth affirmative vote, shall have the power to pass, repeal, or modify any by-laws pertaining to matters not expressly specified in this constitution.

ARTICLE XII — AMENDMENTS

Section 1 — Amendments to this constitution may be proposed by any one regular member of the AIIE or by the Executive Council.

Section 2 — Any amendment shall require for its passage a three-fourth affirmative vote of the National Convention.

Section 3 — A copy of the proposed amendment shall be sent to each regular member by the executive secretary at least sixty days before the National Convention.

Section 4 — If desired, a mail vote on a proposed amendment may be taken by the executive secretary. In this case, ballots shall not be counted for sixty days after the mailing, date, and the affirmative vote of a majority of the entire regular membership shall be required to amend this constitution.

ARTICLE XIII — EFFECTIVE DATE

Section 1 — This constitution shall become effective upon ratification by a simple majority of the charter membership.

Section 2 — A charter member shall be defined as a member on the rolls of the AIIE at the time the constitution is mailed for the vote.

BY-LAWS

ARTICLE I — AWARDS

A distinguished service award of appropriate design may be awarded to any member of the AIIE who, in the eyes of the National Convention that makes the award has rendered some outstanding service to his profession. No more than one award shall be made at any one convention. Nominations for this award must be submitted to the executive secretary either by chapters or by regular members at least five months before the date of the Convention. The executive secretary will present the nominations to the Board of Trustees which will make a recommendation to the National Convention.

ARTICLE II — COMMITTEES

Standing committees of the AIIE shall be: Executive and Membership, as defined in the Constitution, Professional practices, and education. All standing committees except the executive committee, and all other committees shall be appointed by the president and shall perform such duties as may be assigned by him.

ARTICLE III — SPECIAL DUTIES

Each vice-president shall check the activities of the chapters in his region and present an annual report to the Executive secretary. In addition, he shall arrange for a regional conference and he shall encourage a large turn-out of the unaffiliated membership. He shall present a brief, written report on his region to the National Convention.

ARTICLE IV — BOARD OF TRUSTEES

Section 1 — Any regular member of the AIIE is eligible to become a member of the Board.

Section 2 — The Board shall hold at least one meeting a year, the expense of such a meeting being paid from the funds of the National Treasury.

Section 3 — The Board of Trustees shall be the administrative body of the AIIE and may delegate duties to the executive committee.

Section 4 — The National President shall prepare a detailed report to be presented to the National Convention every year.

Section 5 — The Board of Trustees shall have such powers as are necessary to the proper functioning of the AIIE, provided that nothing in this section shall be construed as contrary to the constitution, by-laws, and ideals of the organization.

ARTICLE V — FINANCE

Section 1 — The fiscal year shall be the calendar year.

Section 2 — The dues shall be as follows: student members, one dollar; junior members, two and one-half dollars; and active members, five dollars per year. The initiation fee for all regular members shall be two dollars with the exception of student members who, upon graduation, may transfer to junior membership by paying student dues for one additional year.

ARTICLE VI — MISCELLANEOUS

Section 1 — Robert's Parliamentary rules of order shall be the standard authority for all business transacted.

Section 2 — Reports shall be made by every officer of the AIIE whether National or local, whenever required to do so by the Board of Trustees. Each chapter chairman shall prepare a report for presentation to the National Convention.

Section 3 — The expenses of the Board of Trustees shall be paid from the treasury as directed by that Board.

ARTICLE VII — AMENDMENTS

These by-laws may be amended at any time by a three-fourth affirmative vote of the Board of Trustees. Any amendments adopted shall not become effective for a period of thirty days.

Respectfully submitted,
Constitution Committee
Walter H. Friedlander, Chm.
Joseph Myers
Thomas Kenan

Finances Of The Institute

Because of pressure of other engagements the firm of Certified Public Accountants who audited the records for the year ending March 31, 1950, has not yet been available. Nevertheless it has been decided to publish the statement prepared by our own accountant. Last year no changes were made by the independent auditor.

All money received is deposited in the Huntington National Bank of Columbus. Disbursements are made only on cheques signed by the treasurer, or in emergencies by the Executive Secretary. Both men are under fidelity bonds payable to the A.I.I.E. It will be noted that records are kept on a strictly cash basis and furniture, fixtures and office machinery worth $450.00 is not shown. No officer receives any compensation.

American Institute of Industrial Engineers
FINANCIAL REPORT

Receipts and Disbursements

RECEIPTS:	12 mos. ending March 31, 1951	3 mos. ending March 31, 1951
Initiation Fees	$ 194.00	$ 52.00
Junior Dues	549.65	330.65
Senior Dues	1,002.50	437.50
Student Dues	1,363.60	316.60
Pins	223.00	66.75
Certificates	5.00	
Miscellaneous	277.32	9.98
TOTAL	$3,615.07	$1,213.48
DISBURSEMENTS:		
Telephone	$ 42.46	$ 7.96
Supplies	455.97	127.45
Rent of Office	200.00	75.00
Clerical salaries	1,461.00	244.20
Postage	250.86	90.09
Refunds, rejected applic.	40.00	12.50
Pins	157.49	70.55
Printing (incl. Journal)	742.54	
Miscellaneous	232.55	26.71
TOTAL	$3,582.87	$ 654.46

Position

Cash in bank, subject to cheque	$1,537.83
Cash in office petty cash fund	3.42
TOTAL	$1,541.25
Less accounts payable 3/31/51	107.10
Cash available for operations	$1,434.15

National Committee Organization

President Robert E. Allen has appointed eleven national committee chairmen and some of the personnel of a number of them. Other members who are interested in any particular committee work are requested to notify National Headquarters. The committees and present personnel are as follows:

1. *On Synthetic Time Systems*
   Chairman Mr. K. T. Korn, 610 Nat'l. City Bank Bldg., Cleveland 14, Ohio; Mr. Herbert K. Dowler, 511 Thayer Ave., Ashtabula, Ohio; Mr. L. M. Ufholz, Am. Greeting Publishers, 1300 West 78th St., Cleveland 2, Ohio.
2. *On Industrial Safety & Accident Prevention*
   Chairman Mr. Jack Mims, 1327 Wood St., Dallas, Texas; Mr. Hugh Monroe, Dist. Safety Engr., Abilene Dist., Texas Employers' Insurance Ass'n., Dallas, Texas; Mr. George D. McCeney, 300 Insurance Bldg., National Surety Corp., Richmond, Va.
3. *On Statistical Quality Control*
   Chairman Mr. Joseph Movshin, Wagner Electric Corp., 6400 Plymouth Avenue, St. Louis, Mo.
4. *On Production Control Systems*
   Chairman Prof. C. B. Foos, School of Industrial Engr., Georgia Inst. of Technology, Atlanta, Ga.; Mr. G. T. Mitchell, 19 Dover Rd., Long Meadow, Mass.; Mr. Norman V. Gomes, 716 West State St., Trenton 8, N. J.
5. *On Materials Handling & Handling Costs*
   Chairman Lt. Col. John D. Day, School of Industrial Engr., Georgia Institute of Technology, Atlanta, Ga.; Mr. Dominic C. Giovinazzo, 663 West Highland, Ravenna, Ohio.
6. *On Industrial Engineering Terminology*
   Chairman, Mr. Richard J. Bess, 1415 East Washington, South Bend, Ind.
7. *On Application of Industrial Engr. Techniques to New and Unusual Fields*
   Chairman not yet appointed.
8. *On Membership*
   Chairman, Mr. Jas E. Shondell, 2531 No. 4th St., Columbus, Ohio.
9. *On Registration*
   Chairman, Mr. Jos. C. Nichels, 3245 Lubbock St., Ft. Worth, Tex.
10. *On Chapter Organization*
    Chairman, Mr. Paul R. Grady, Portsmouth, Ohio.
11. *On Public Relations*
    Chairman, Mr. Sam D. Lockskin, 490 Crescent Rd., Mansfield, Ohio.

It is expected that the committees will work toward standardization of Industrial Engineering practice in their respective fields. The program will take long; not to complete, for the work will never be completed, but to make significant progress. No doubt interim reports and monographs will be published.

Dues Increased

All members are reminded, as reported in the last issue of the News Letter, the By-Law covering dues was changed, effective May 1, 1951. The current rates are as follows:

Student Dues	$2.00 per year
Junior Dues	5.00 per year
Senior Dues	10.00 per year

The initiation fee still remains at $2.00. All members pay dues only for the actual time they belong as Student dues are pro-rated if collected after Dec. 31st so that all student memberships expire on Sept. 30th. Junior and Senior dues are either pro-rated (certain chapters collect their national dues) or mature on the anniversary date of the membership.

Readers who have examined the financial statement elsewhere in this issue will observe that during the last fiscal year receipts exceeded expenditures by only $32.20. At the same time a number of projects which members have requested have been delayed due to lack of funds.

In addition to these reasons is the fact that rising costs of all goods and services required to operate the Institute made it imperative for the Board of Trustees to obtain more income. Many members recognized this problem and suggested that AIIE dues were too low in relation to its objectives and to the charges of other technical professional societies.

WHAT IS STATISTICAL QUALITY CONTROL?

. . . by Ralph A. Hefner

Dean, Division of General Studies, Georgia Tech

Most articles on statistical quality control are written to instruct the potential user in the techniques and mathematics of the subject. Dr. Hefner's discussion, however, deliberately departs from this approach and devotes itself to a simple, highly informative description of the basic principles, the reasons for their use, and the advantages thereof.

Many industries, both large and small, are already thoroughly acquainted with statistical quality control. Having used it in their plants for several years, they have verified for themselves the startling results that can be obtained by applying statistical principles to the control of the quality of their products.

Other industries, however, have heard only vaguely that a new technique has been developed for the control of product quality. These are the industries that are now asking the question, "What is statistical quality control"?

When a person asks this question, he is, in most instances, asking to be told what statistics has to do with the control of quality. It does not occur to him that his ideas of "quality control" may also need clarification, yet it often happens that the use of statistics in the control of quality is difficult to understand simply because no clear agreement has been reached as to what is meant by "quality control" itself.

One cannot thoroughly understand statistical quality control until an agreement is reached as to what is meant by "quality", then, what is meant by the "control of quality."

What Is Quality?

What does the word "quality" mean when applied to a manufactured article? It requires only a moment's reflection to realize that when one speaks of quality, one may be speaking of a great many different attributes. A characteristic that would be regarded as of vital importance in one manufactured article may be a trivial characteristic in another.

In the manufacture of a crank shaft for an internal combustion engine, certainly, the diameter of the shaft is of vital importance. On the other hand, in the manufacture of an aspirin tablet, the exact diameter of the tablet is immaterial, but the weight of the tablet is of prime importance.

So it is with every manufactured article. There are always one or more characteristics that are of vital importance if the article is to be judged of good quality. This importance characteristic—whether it be the length of a valve stem, the diameter of a bolt, the weight of a powder charge, the tensile strength of cotton yarn, the life span of a tire, the crushing strength of concrete, or any other desirable quality — is what a manufacturer tries to build into his product.

Specifications

Before production begins, the desired quality characteristics should be decided upon and then should be written into the specifications. The description of the article to be manufactured is in actuality the description of the *ideal* article desired, and it is the manufacturer's task to make his product as nearly identical to the ideal article as is practical and profitable.

Actually, of course, no manufactured article is *exactly* like the ideal article specified. One may wish to make a bolt 20 mm. in diameter, but, no matter how much care goes into its manufacture, the actual diameter is never *exactly* 20 mm. In fact, in spite of all that one can do, no two manufactured bolts selected at random ever have exactly the same diameter.

Here is a fundamental truth that must constantly be kept in mind. No matter what the desired characteristic of the article which one is trying to manufacture, it is inevitable that this characteristic will vary from article to article. There is always a certain amount of variation present, be it little or great. The fact that no two articles can ever be made exactly alike is inescapable, and one is forced to be content to make them as nearly alike as possible.

Variation

Obtaining manufactured articles of good quality, then, simply means that variation in the quality characteristic desired is being held within certain acceptable limits.

With this idea of quality thoroughly in mind, it is not difficult to agree on what "control of quality" should mean — that the amount of variation in the desired characteristic is to be held within as narrow limits as is practical or economical.

The fundamental ideas expressed thus far are so important that they can profitably be restated briefly. Inherent in every manufacturing process is a certain amount of variation. The amount of this variation depends upon the process itself, and it is the control of this variation that determines the quality of the finished product.

Two kinds or types of variation are found in manufacturing processes: *random variation* and the *variation due to assignable causes.*

To the statistician, random variation means that the process is operating under *a constant system of chance causes.* Stated more simply, random variation may ful to the manufacturer—random variation which can be regarded as usual or normal for a process when that process is doing the best that it can. Stated a third way — one perhaps more meaningful to the manufacturer-random variation is caused by so many and varied factors that it would be futile or uneconomical to attempt to find them.

Variability due to assignable causes means exactly what it says. There is present a cause of variation that can be sought for profitably and, when found, can be economically removed. Obviously, this latter type of variation can be controlled, and, just as obviously, the former cannot. Therefore in any instance the question always arises: "Does the process as it is now operating contain both types of variation"?

Use of Statistics

It is precisely at this point that the science of statistics enters the picture. It is the tool that differentiates between the two types of variation and it tells one when the cause of variation can be found and eliminated and when to let the process alone because it is doing the best that it can.

Statistical control of variation, therefore, deals with a quantitative measure of variability. It tells when the variation is large enough for a profitable search to remove the cause, or when it is small enough to let it alone. Statistical quality control gives one an objective rather than a subjective judgment of the variation that can be regarded as usual for any given process.

It is this fact that gives statistical quality control much of its power and usefulness. By its aid, an inexperienced foreman can judge a manufacturing process as well as the foreman with years of past experience to call upon. In fact, it frequently happens that the use of statistical quality control surprises the older foreman by showing him that his past experiences are not always an infallible guide. One instance of this might be of interest.

During the war, an old, established firm converted its plant to the manufacture of many of the various parts that go into an airplane engine. The chief engineer was responsible for the control of quality in this plant, and hearing of

statistical quality control, he availed himself of the first opportunity to take a course in which the subject was taught.

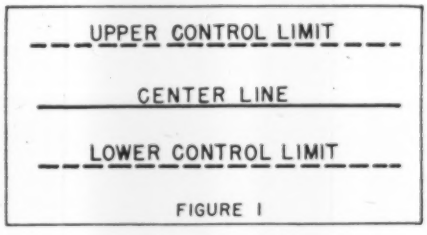

FIGURE 1

Returning to his plant, he thought of several processes that he knew were not operating at their best and hoped that his new knowledge would help him to locate and eliminate the troubles. However, his training in statistical quality control had not been very intensive, and he did not feel that he knew enough about it to apply it to a process in which he knew there was trouble. As a start, and in order to gain experience with statistical quality control, he decided to apply its principles to a process that had never given him any trouble. It was true that the process was turning out some unacceptable pieces, but the scrap amounted to only five per cent of total production, and he knew that the output of all other firms manufacturing this same item was running as high as eight and ten per cent scrap. In addition, his previous experiences in making such items told him that it was unusually good to have only five per cent of the items fall outside the close tolerances allowed. In short, experience told him his process was doing the best it could and that it needed no further attention.

Applying the analysis of statistical quality control to this process, he was amazed to find in actulity the process was not doing the best that it could. Upon investigation, he found that the parts in question were being made on four automatic machines and that an endless belt brought the finished articles to an inspection table where each was examined and the five per cent not conforming to specifications were discarded. By inspecting the output of each of the machines separately, he found that all the bad pieces were being turned out on one machine. This machine was immediately taken out of production and dismantled. A defective part was found, and, when it was replaced, the machine no longer produced articles that did not meet the specifications.

The above illustration is typical. As long as the judgment of a given process is subjective rather than obpective, there is always the danger of deciding that the observed variation in quality is random, when in reality it contains variation due to assignable causes.

Control Charts

To determine objectively the type of variation that is occurring in any given manufacturing process is relatively simple. This is done by constructing what is known as a "Shewhart control chart." To construct such a chart, one carefully examines a number of products of the manufacturing process under observation. A few simple statistical calculations are then made, and the chart is drawn, usually taking the form shown in Figure 1.

The solid line down the center is known as the *Center Line* and represents the average quality of the characteristic being manufactured. The dotted lines appearing on either side of the central line are called *Control Limits* and represent the extreme limits to be expected in the manufactured characteristic if the process is doing the best it is capable of doing. After the lines are drawn on the chart, the actual results of the manufacturing process are plotted as points. Each point usually represents the average quality observed in five selected samples.

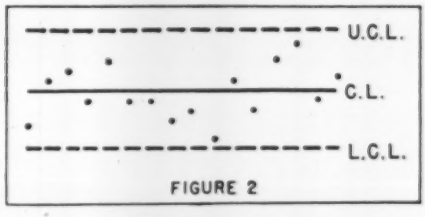

FIGURE 2

If all the points represents actual production fall within the dotted line, as shown in Figure 2, the process is said to be under *statistical control.* This means that the variation in quality is completely random, or that the process is operating under a constant system of chance causes. No amount of minor adjustment or tinkering with the process will affect the quality of the product; in short, the process is operating at its best.

If, however, some points fall outside of the control limits, as is the case in Figure 3, the process is said to be out of statistical control and is not turning out products of as good a quality as it is capable of manufacturing, meaning that there are one or more assignable causes of variation present. To one familiar with the manufacturing process, it is usually a relatively simple matter to search for and to find these assignable causes of variation. Once the cause of variation is discovered, it can then be eliminated, with resultant improvement of the product. If all such assignable causes of variation are removed, then all the points representing future production will fall within the dotted control lines.

It is well to point out here that the control limits — the dotted lines that differentate a process that is doing the best it can from a process that is not — are not placed on the chart arbitrarily, nor are they the results of some individual's opinion. These dotted lines are determined by the process itself. It is as if one went to the manufacturing process and asked it, "What kind of work are you capable of doing?"

"The dotted lines," would be the answer. The process in effect says, "This is what I am capable of doing. When I am operating at my best, all my production will fall between these two dotted lines."

As long as a manufacturing process is out of statistical control, there is no way of predicting what the quality of any future production will be. There is only one way to assure quality from such a process; it is necessary to inspect each and every article manufactured in order to discover and to discard those whose quality characteristics fall outside the acceptable limits.

On the other hand, if a manufacturing process is under statistical control, as illustrated in Figure 2, then one can safely assume that all future production will fall within the control limits. In such a case, all that is necessary for one to do to assure the quality of future production is to take a sample from the process at convenient intervals to see that the process is remaining in control.

It is this statistical fact that has been of so much value to manufacturers using statistical quality control. Once their manufacturing process has been brought under statistical control, inspection is reduced to a very small fraction of what it was before statistical control was established. In many instances, this has resulted in a tremendous saving, since the manufacturer's cost of inspection has been greatly reduced while at the same time the quality of his finished product has been assured.

Specification Limits

After a manufacturing process has been brought under statistical control, two other lines representing the *specification limits* can profitably be placed on the control chart for individual items. If it should happen that the specification limits fall outside the control limits, as illustrated in Figure 4, the manufacturer can rest assured that all of his production will meet specifications, and he

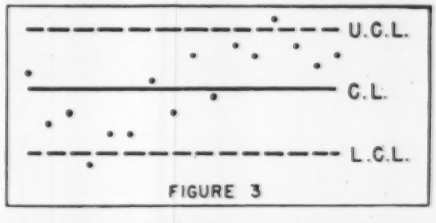

FIGURE 3

(Continued on page 17)

Book Reviews

MANAGERIAL ENTERPRISE

by Oswald Knauth
W. W. Norton, 1948

Reviewed by Professor Robert T. Livingston, Head, Department of Industrial Engineering and Management, Columbia University

This is an interesting and perhaps important book. Important not so much for what he actually proves — as the text does not prove the theory — as for what it suggests. The theory is that here in America we have developed a new economic system that differs so much from "free enterprise" on the one hand, or monopoly on the other, that the theories evolved from attempting to adapt them are not very revealing.

Having in effect stated this, he spends most of the book in a description of the "new" system. The description is not very convincing as most of the things he describes seem to be but logical derivatives — this of course does not destroy his theory but he does not anywhere categorically set up his points.

Toward the end he poses some questions and problems which must be solved but these are not very coherent or well organized.

Mr. Knauth feels that the title "free enterprise" is no longer valid and that what we have is a system of managerial enterprise. To start, this is somewhat like Burnham's concept. It is of course true that, in the development of the modern large corporation, the owner no longer occupies the position that he previously did. The owner is no longer the manager and the manager while, of course, owing a debt to ownership is no longer under the complete dictation of ownership that he used to be. This has bad as well as good points. The question naturally arises as to whether management under no direct compulsion and only concerned with retention of its own position will be wiser or more competent than under other stimuli. All of this leads rather obviously to the field of government management. Just what is the difference?

Mr. Knauth seems to feel that the stimulus is a continuation of authority and one must naturally ask whether that is good or bad.

He stresses:

(a) the increased size and specialization of capital equipment
(b) its value can only be extracted over a relatively long period of time
(c) long time continuity of the association
(d) the necessity for long time planning
(e) tendency to "control" from raw material to consumer

He says that in a "free enterprise" system costs can be estimated with a relatively high degree of accuracy and the assumption follows that they cannot in a "managerial enterprise" system, largely because of the problem of "allocation' which involves assumption.

Our present system, that Knauth calls "managerial enterprise" does not fit into the logical pattern of monopolistic competition derived from the theory of monopoly or from the concept of imperfect competition which is derived from the theory of free enterprise.

Competition has its strange aspects. While Macy and Gimbels are rivals yet either would suffer if the other went out of business.

The theories of free enterprise and the theories of monopoly have little to offer in the solution of this problem.

He poses certain questions which he says must be answered:

1. Is competition desirable and if so, to what extent? Is it socially possible to permit large units to be ruined?
2. To what extent can production be controlled to coincide with consumption — thus reduce boom and bust tendencies?
3. How about size?
4. How should management be selected and how controlled?
5. Are government corporations such as the T.V.A. desirable as yardsticks or should government actually subsidize competition?

This book is well worth reading but it is doubtful if it will help solve any problems.

THE SCIENTIFIC APPRAISAL OF MANAGEMENT

by Jackson Martindell
Harper and Bros., N. Y., 1950 — 278 pages and appendix

Reviewed by Robert Teviot Livingston, Professor of Industrial Engineering and Management, Columbia University.

Mr. Jackson Martindell, President of the American Institute of Management has written an interesting book which distills his long professional experience into fourteen chapters starting with a definition of the general problem and successively proceeding through many of the important areas and aspects of management ending with a summary which he calls "The Principles of Excellent Management." Except for the lack of references and citations, this book could well serve as a text for a valuable graduate course in a Department of Industrial Engineering.

The title is unfortunately misleading. One expects that a method will be submitted by which the management of an enterprise can be objectively measured and evaluated. While an excellent appendix presents "Management Audit Material" and the appendix is labelled "The Objective Method of Management Audit", the scoring system submitted is entirely arbitrary and the method of determining the score completely subjective. Similarly, throughout the book, few if any actual "measures of management" are submitted; certainly none that can actually be quantisized and this in spite of the challenging statement on Page VIII of the Preface:

> ". . . the problem . . . is . . . one of devising means whereby the special qualities of individual managements can be measured"

If this is the problem, and it is, then the author never really faces it. Occasionally he approaches it and in his final chapter he makes some summary generalizations but he never comes out and says "This management is better than that management *because* . . . ."

Part of the faults lies in the adherence to the now outmoded case system and his refusal to generalize. However, the cases used are excellent, usually two differing considerably are presented and the reader cannot help but draw many conclusions from the material submitted, in spite of the absence of the author's conclusions.

The problem considered is definitely *Top Management* and the accent is on major decisions and how they are arrived at. Each case is presented clearly and the matters which must have influenced the decision and the possible results of alternative decisions are presented. This method and the covering explanations and generalizations draw the reader into the problem so that he gets the feeling of understanding and actually participating in the decision. It is this that lends an air of reality which is so lacking in most books on the subject. The chapter on research is excellent, this alone making the book worth-while reading.

Perhaps one of the most interesting aspects of the book is the challenge to management which is presented. According to the author, the decrease of production per worker and the rising cost of production is not blamed upon the worker, or upon the "decay of the social system," or the unreasonable demands of organized labor but squarely where it belongs on uninspired and incompetent management. In a word, it is "stupidity" not "cupidity" which is to blame. Ownership, due to its increasing diffusion has little influence, directors are generally too old, too conservative and too uninterested in the real problems of the companies. Who then is to be blamed and who must grow up? It is obvious: Management!

STATISTICAL QUALITY CONTROL

(Continued from page 15)

may stop all inspection except for an occasional check to see that the process is remaining in statistical control.

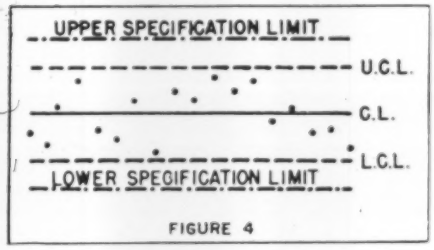

FIGURE 4

Should the specification limits fall within the control limits, as illustrated in Figure 5, this presents altogether another problem. First, one must remember that the process is under statistical control, so that, even though it is doing the best it can, there will inevitably be points falling outside the specification limits, since points may fall anywhere within the control limits for a process that is in statistical control. In such a case, a point outside specification limits,

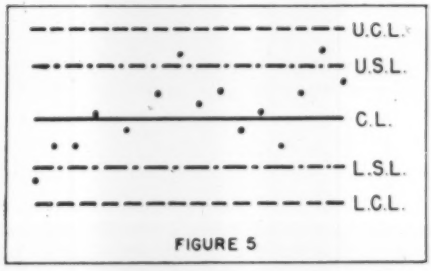

FIGURE 5

although it is within control limits, represents characteristics of unacceptable quality. Therefore although the process is under control, some scrap will inevitably be manufactured. As has been stated before, no amount of adjusting or tinkering with the process will improve the situation. Nothing short of a major change in the process such as new machines, new methods, new materials, or different operators will bring the control limits closer to the central line. If the specification limits cannot be widened, either the process must be completely changed or the unacceptable quality items must be screened by 100 per cent inspection.

Manufacturers who have been using statistical control state that, in many such instances, a conference between the manufacturer and the user of the product has often resulted in a relaxing of the specification limits. When all parties concerned are familiar with the assurance in quality that is given by a process that is under statistical control, they usually find they do not need the protection of extremely tight specification limits.

Who Can Apply the Method?

Many manufacturers, hearing of statistical control, would like to try it but are frightened by the word "statistical." They fear the need of a highly trained statistician to do the job. Actually, such is not the case. In fact, it is much better to take a person already familiar with the manufacturing process and then teach him how to use statistical quality control. It has been aptly and accurately stated that statistical quality control is less than five per cent statistics and over 95 per cent engineering or technical knowledge of the process under consideration.

Any person with as much as high school training in algebra and arithmetic can make the calculations necessary to draw the control chart and place the production points on it. In most plants, relatively low-salaried clerks do this part of the work. Once the charts are prepared, they are studied by the chief inspector or production engineer, or whoever is in charge of quality control. If the person in charge has had sufficient training in the control of quality through statistical methods, he is then able to interpret the charts and to take whatever action they indicate to be necessary.

During the war years, statistical quality control was taught to chief inspectors and engineers from war plants in ten-day intensive courses. It was found by experience that a person familiar with a manufacturing process could be taught enough statistical quality control in ten 8-hour days to enable him to start using the process successfully in his own plant.

These ten-day wartime courses were taught under the auspices of the Office of Production Research and Development. Since the close of the war, several schools scattered throughout the United States have continued to offer ten-day intensive courses in statistical quality control, once or twice a year. The tuition charge, which includes all the necessary books and materials, is usually around $100. More and more manufacturing plants are learning that it is highly profitable to meet the cost of training their personnel in this new method of controlling quality. In most instances, the first application of statistical quality control results in a saving to the manufacturer that more than meets the entire cost of the course.

The use of statistical quality control, then, simply adds a few easily employed statistical tools to the store of knowledge already possessed by the men responsible for the control of quality of manufactured articles. These tools, however, enable a quality control department to bring to bear on its tasks the powerful theorems long used by the statistician.

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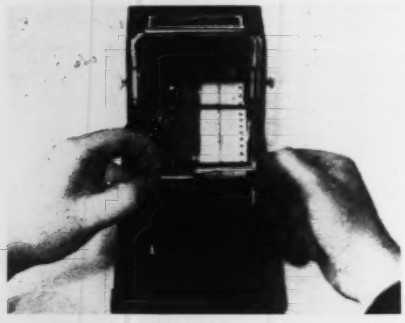
Have You Seen This?

Recording Gage Posts Its Own Quality Control Chart

Realizing that the recording of measurements and the application of statistical quality control would be greatly facilitated by incorporating the control chart in the inspection instrument, Federal Products Corporation developed the illustrated Model 500 Recording Gage. This device saves considerable time for the inspector since it automatically posts



its own chart. Also human errors in reading the gage and recording the measurements are eliminated.

PNEUMATIC REVERSIBLE SCREWDRIVER

Scarcely larger than a fountain pen, the Cleco A-1 Screwdriver is especially designed to speed production jobs that require driving many small screws and other fasteners up to the equivalent of No. 8 machine screws.

Small size, light weight and freedom from torque reaction combine to make the Cleco A-1 exceptionally easy to handle. Operator fatigue is reduced, making possible continued high production with minimum spoilage of work and markedly reduced overall costs.

The balanced impact mechanism absorbs the driving torque, permitting finger-tip operation and control. There is no possibility of the tool twisting in the operator's hand or jumping out of the screw slot.

The Cleco A-1 Screwdriver is extremely economical in air consumption during operation. Also, since the throttle valve is opened by pressure on the bit, wasteful "free running" is eliminated.

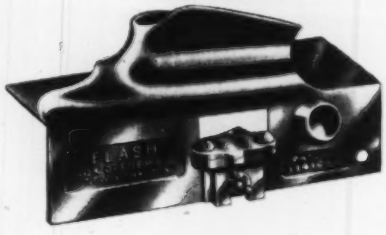
Rotation is easily reversed — making it possible to remove screws rapidly. External adjustments for power and reversing make disassembly of the tool for adjusting unnecessary.

Length, 5-7/16"; Maximum Diameter, 21/32"; Weight, 9-1/2 ounces; Capacity, No. 8 Machine Screws or equivalent.

The Cleco A-1 Pneumatic Reversible Screwdriver is manufactured by the Cleco Division of the Reed Roller Bit Company, P.O. Box 2119, Houston 1, Texas.

Flash Box Opener

Flash Box Opener Co., Inc., 52 West Houston Street, New York 12, N. Y., announces an improved Flash Opener. It is the only carton opener with the exclusive patented blade holder that is speedily adjusted to cut varying thicknesses of carton covers. This amazingly new and patented box opener opens any carton quicker and cleaner. The Flash Box Opener protects contents of cartons because it penetrates exactly under the outer cover thickness. It cuts cleanly, permitting reuse. Flash Box Opener protects the user from injury. The Flash Box Opener is made of durable zinc.



NEW CARDINEER FILE ROTATES HORIZONTALLY

No "in the hat" record-keeping system is this new Cardineer Horizontal Rotary File. It brings orderly record-keeping where activity is high and an inefficient system would waste time and money.

As a rotary file, it's unusual in that it revolves in a horizontal, instead of a vertical, plane. Thus, all the records are in a natural position for posting or reference without removing them from the rotor.

This compact unit well serves the requirement where breaking down of large concentrations of records into small work-units gains the advantage of a high degree of control and accessibility. Where there is a large amount of casual reference by persons other than the regular operator, this breakdown of records allows several persons to us them free of interference with each other — saving the time that would be lost otherwise.

Each file holds up to 2,700 records in a convenient working position — no containers to open; no drawers to pull out. A natural, wide-open working "V" makes it easy to post to the records in their normal position on the rotor. All the advantages of Cardineer Rotary Filing — better control of motion, space, time, and economy — are now offered for smaller installations through this horizontal Cardineer.

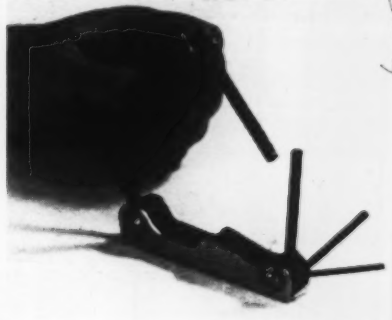
No adjustment is necessary when adding or removing a record — records are added or removed in one motion at any place in the file.

Records are housed on three removable trays, allowing distribution of record-keeping work. These trays are self-supporting when off the rotor.

Records in a large variety of sizes up to 8 x 8, or 9 x 5½ inches, can be accommodated on this all-steel file. This new addition to the Cardineer line is manufactured by Diebold, Inc., Canton 2, Ohio.

5-In-1 Socket Wrench Set Saves Time

Eliminate the element "find socket wrench" by putting Smitty, the compact 5 unit socket wrench set, in the pockets of the maintenance men. Write to R. N. Hunter Sales Co., Los Angeles 23, Calif. for details.



VOICE COMMANDS OPERATE BI-LINGUAL ELEVATOR

A bi-lingual elevator was demonstrated to conferees of the recently held Building Owners and Managers Association convention in Montreal, Quebec, Canada — the French and English speaking city.

The elevator operator didn't pull a handle, or push a button, or even touch a button. But when he called out "going up" or "monter" into a microphone, the elevator doors closed immediately and the car rose to its destination. He

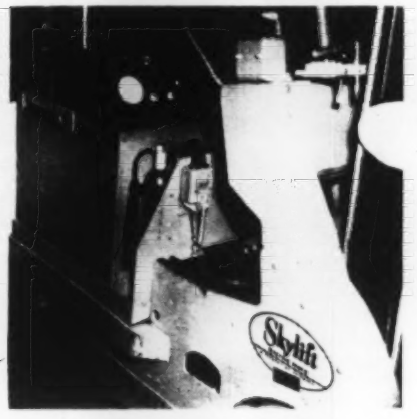
called out "down please" or "descendre" and the car returned to its starting position.

The elevator car was a model, one foot high, that responds to voice commands — in English or French.

The bi-lingual elevator travelled up and down between three "floors" in a ten-foot-high model hoistway. The passenger cab and hoistway were complete with working miniatures of all the standard equipment found in elevator installations — safety, speed governor, counterweight, oil buffers, guide shoes and guide rails.

Two-way Radio— The Latest Handling Aid

Two-way radio sets on fork trucks are the latest wrinkle devised by materials handling engineers to cut costs. Wasted



time and traveling without loads are slashed by up-to-date communications. Photo shows a Skylift electric truck, made by the Automatic Transportation Company, Chicago, equipped with a Motorola two-way short wave set. A fleet of seven Skylift trucks have been equipped this way at the Johnson & Johnson shipping center, Metuchen, N. J.

SIMPLIFIED PACKAGE HANDLING

The "Beacon Claw" simplifies box and package handling, is extremely lightweight yet has a capacity of 500 pounds to 1000 pounds. The grab exerts its own pressure, the heavier the load the tighter it holds. Heat treated spurs in the jaws are easily replaced, and narrow jaws allow for close stacking. Other jaws are lined with non-slip material for handling cartons. Handling of boxes and cartons is expedited because of the ease with which it operates. Operation involves merely setting it over a box and lifting.

The grab is made in three standard sizes: 4" to 10", 10" to 20", and 20" to 30". Variations of these sizes as well as a variety of jaw designs may be obtained. For further details, write to Cleveland Beacon Products Co., 1480 Lakeside Ave., Cleveland 14, Ohio.

AUTOMATIC TIME

By WILSON J. BENTLEY

A DEVICE for automatically recording time elements has been designed by Mr. H. G. Thuesen, Professor of Industrial Engineering and Head of the School of Industrial Engineering at Oklahoma A. & M. College. This Time Recorder was constructed in the Oklahoma A. & M. College Engineer Experiment Station and is now being used by the School of Industrial Engineering in connection with Time Study Research, Training, and other similar activities.

In ordinary practice, time study readings are taken with a decimal timer which records to 1/100 of a minute. In using a decimal stop watch, the time study observer must record the action taking place, note the watch reading at the end of an element, and then record the time noted. This common practice necessitates the shifting of the observer's attention from the work being observed to his watch, and then, to the time study observation sheet. For short cycles of time, as encountered in time and motion study research, the accuracy of the observer in noting and recording the elemental times leaves much to be desired. Designers have sought to overcome the short comings of the decimal stop watch by employing a Kymograph in which electrically controlled scribers record on a moving tape. Since a linear distance on a tape in this device is a measure of elapsed time, it becomes necessary to make linear measurements of the distances between records made by these scribers. It can be readily seen that the work of reading the distances on the tape becomes a limiting factor in making an extensive research or when time values are needed immediately after they have been recorded.

This timing device which Professor Thuesen has designed records the time of the occurrence of an event to 1/1000 of a minute directly in numbers placed in order of their occurrence on a roll of paper. The device is manually operated to the extent that the operator must depress a small lever at the instant a recording is desired. By this action the time is recorded on the roll of paper. The Time Recorder has guides which enable the observer to write in symbols and words the description of the time reading. Thus the subject may be observed even when readings are being made and recorded. The device actually has three spaces which the observer may use. These spaces are placed so that he may record the description either previous, during, or after the recording of the time.

To describe the Automatic Time Recorder more specifically, it can be said that the elements of time are obtained by driving two print wheels with a synchronous induction motor. These wheels are graduated from 00 to 99 around the circumference and are geared so that they record to the nearest 1/1000 minute. When a recording of an element of time is desired, a lever is operated with the thumb, or index finger, which causes three synchronized movements to take place. First, a continuous strip of paper is advanced to a new position and stopped. Second, a hammer surrounded by an inked ribbon falls on the paper directly over the print wheel recording the time at the instant. Third, at the end of the travel, the inked ribbon advances to a new position. Releasing the actuating lever causes the mechanism to adjust itself for the next recording. The result is a continuous strip of paper being reeled upon a removable spool bearing time recordings in minutes, tenths, hundredths, and thousandths of a minute together with identifying marks and symbols inserted by the operator beside each recording.

The recorder is light in weight and easily portable. It has a 15 foot electrical cord which allows the recorder to be used under most shop and plant conditions. The experience of Professor Theusen and members of his staff with the Time Recorder indicates that it will prove to be an efficient means for research and training in time study. Experimentation further indicates that the use of this device can be a valuable aid in both educational and industrial organizations where accurate time measurement is essential.

The automatic time recorder serves a need between that served by decimal timers and a more complex device designed by Professor Thuesen for the University of Iowa. The later device automatically records 12 elements to 1/10,000 of a minute. This timer was built by The University of Iowa and The Western Electric Company for research in motion economy.

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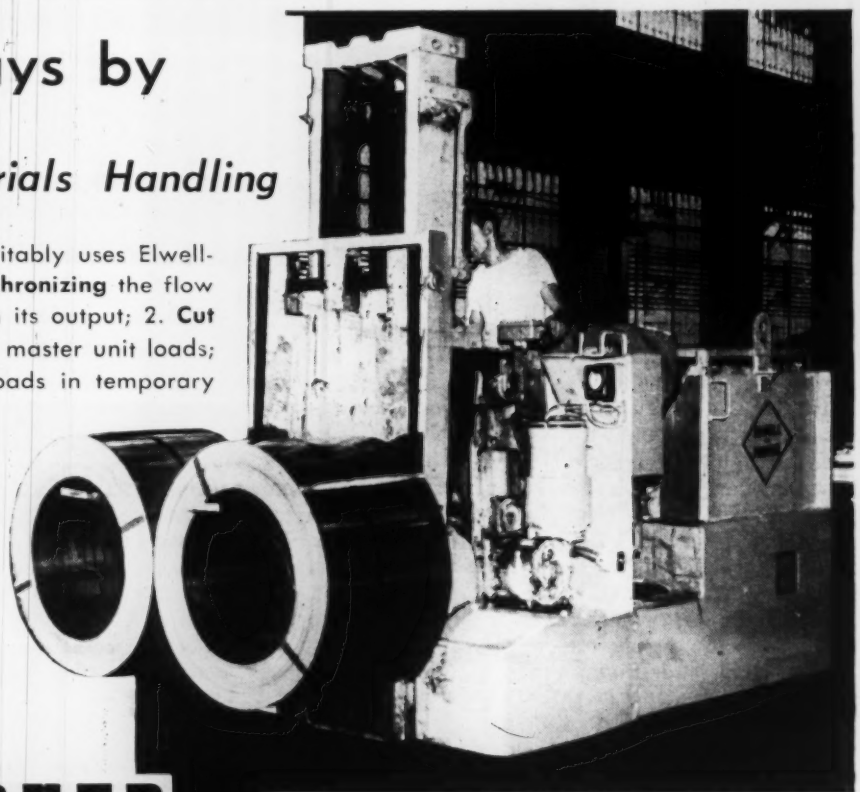

Two 6500-lb. coils being carried in tandem on the tines of an E-P fork truck at a steel mill. This truck with one other Elwell-Parker has carried over 2 million tons in the past 3 years, working 22 hours a day, 6 days a week.

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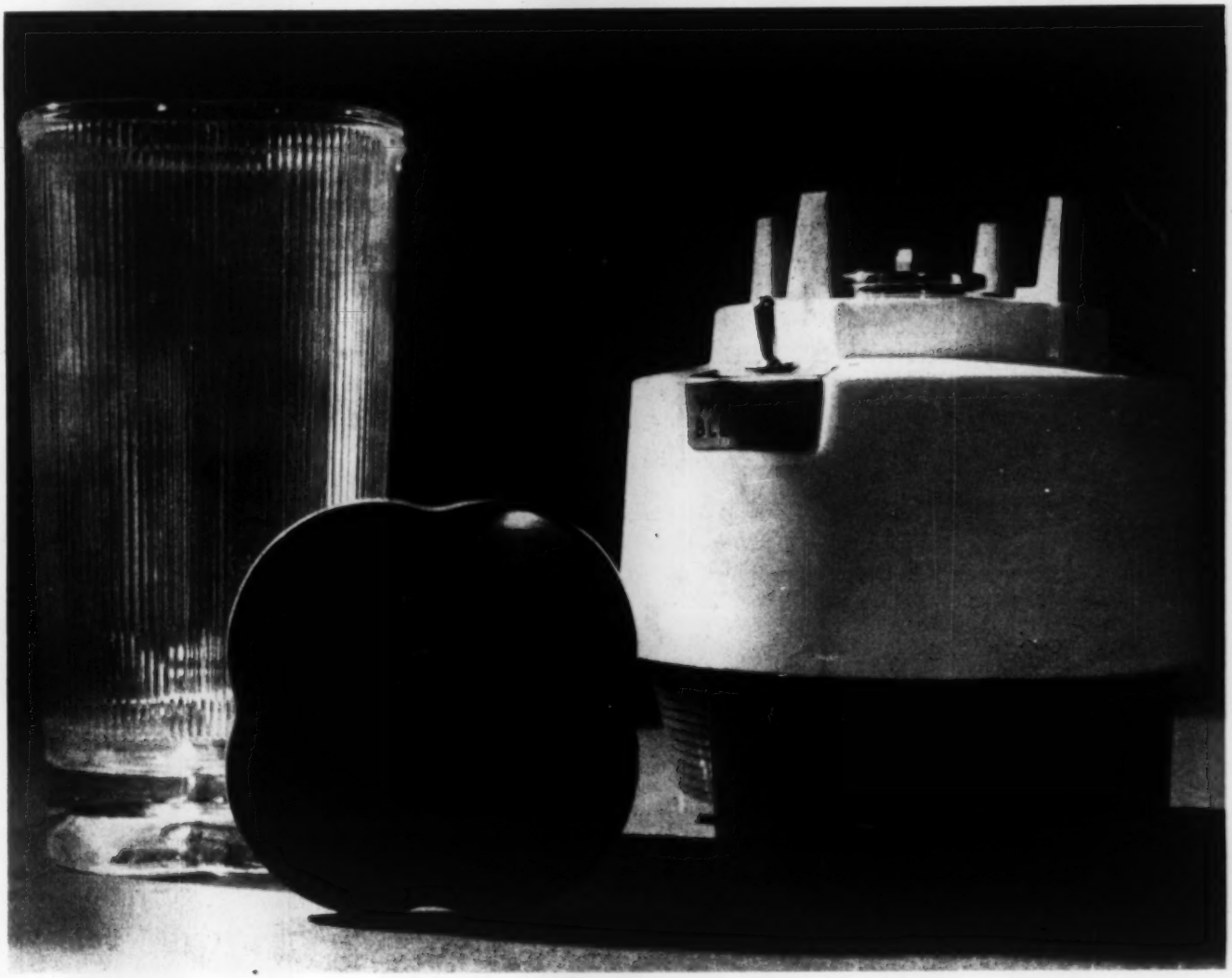

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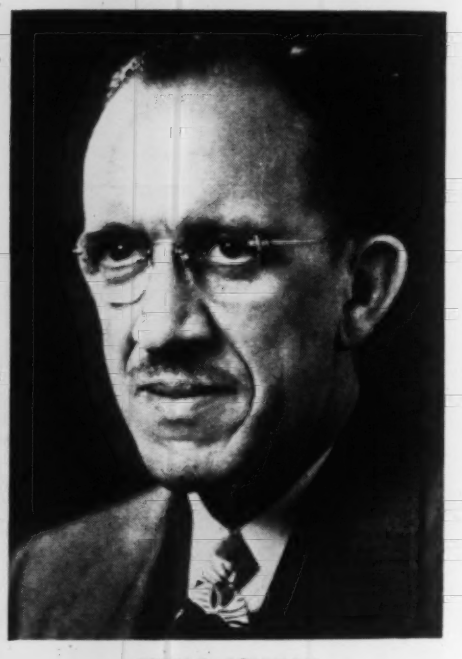
PRESIDENT'S MESSAGE



JOHN D. COLEMAN

The administrative year that is drawing to a close has been one that has presented a great many challenges to the officers but we have been fortunate in being able to meet them, and I am pleased to report that the Institute is in the soundest position in its history.

Our principal problems center around finances and communications with our members, and those reached a climax last fall when we determined that at all costs our membership must be kept informed. The News Letter has proved to be the answer to the problem of communication until we can establish the Journal on a regular basis, and has also assisted materially in improving our financial picture.

From the splendid response we have had from industrial engineers all over the country the conclusion is inescapable that there is a very real need for an organization of, by and for industrial engineers, to develop, evaluate and disseminate data pertaining to this field. The Institute is not a perfect organization, but is is soundly conceived, growing rapidly, and deserving of the support of every industrial engineer who wishes to see this important branch of the profession grow to full stature.

The succeeding administrative year should see the Journal on a regular quarterly basis with the News Letter bridg-

(Continued on Page 11)

THE COVER

A New Product Design by
FRANCESCO COLLURA, S.I.D.,
Instructor of Industrial Design,
Columbia University's School
of Engineering
Photo Courtesy of American Cynamid Co.

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EDITOR'S COLUMN

Here we go again! This will be the first issue of the JOURNAL published in Atlanta.

There is no need to go into the many reasons why the JOURNAL has been so erratic in publication during the past two years. I assure you that the problems involved have been beyond the control of the Institute and in spite of the excellent efforts put out primarily by the important Ohio nucleus which has so strongly supported A.I.I.E. from the beginning.

One of the most important things to a journal is a good supply of top articles and in this respect each of you can make a worthwhile contribution. It is also important that we get your criticisms, both destructive and constructive. It is still more important that you give the JOURNAL every support possible. The paid officers of the Society consist of one full-time secretary at our Columbus headquarters, and every effort is being made to return to you the best possible publication within the funds available for this purpose.

Since Industrial Engineering is one of the most important fields in the world today, one where top-thinking and top-action is necessary and one where workers are very scarce, it is hard to conceive that any one of you is not doing an important job somewhere. Each of us stands to gain from an exchange of thinking and ideas with each other. Ideas are one of the most important commodities in the world today and certainly one of the shortest commodities when we consider that excellent ideas are the only ideas that are worth while.

We have strayed quite a long way from that important principle which has made this United States one of the greatest countries in the world—that idea which promotes more and more products for less and less money. The Industrial Engineer is the one who must meet the challenge to turn the tide and cause the production of more goods at lower prices while at the same time increasing the purchasing power of all levels of workers. Our scientists and other researchers have done a grand job in their field. The philosophy of industrial engineering must be applied very heavily from now on in order that the fruits of this research may be made edible and put on the market at prices we can afford to pay. This applies all the way from coat hangers to the B-47 bomber. We have an oversupply of armchair quarterbacks. Let's put on a uniform and get in the lineup.

COOPERATIVE RESEARCH IN INDUSTRIAL ENGINEERING

. . . by K. Theodore Korn & Vasily D. Prian

RESEARCH COMMITTEE ON SYNTHETIC TIME SYSTEMS

Throughout our studies and re-examinations of the advances made in industrial engineering since Taylor's conception of time study, one fact more than any other forces itself upon the mind of the investigator—the fact that obviously there has not been the rate of advancement achieved as has in other professional fields.

How much more can be accomplished by collaborative efforts of specialists in many fields is well exemplified by the progress achieved in Jet Propulsion, and one might realize how much longer it would have taken a group of aeronautical engineers to construct a satisfactory jet engine. The basic task would have been to construct an engine which would meet the following minimum conditions: High speed operation, long flight range, low specific fuel consumption, reliability and ruggedness, safety of operation, and simplicity of operation. Besides these, there are the requirements of relative simplicity of manufacture and field maintenance.

In its early history the life span of the jet engine was a matter of minutes because the employed metals could not withstand the high relative temperatures developed in engine operation. Since the aeronautical engineer had to work with the known, available alloys, and since he is not fully equipped to develop new alloys he could not have solved this problem without the aid of the metallurgist. The metallurgist, in turn, had to rely upon new, basic findings regarding the molecular and nuclear behavior of metals under critical temperatures which were made available to him by the physicist. He, again, depended upon the mathematician to solve equations which resulted from the transformation of ideas into models, and of models into equations. This is merely a small section of an example illustrating the complexity and multitude of the problems to be solved by cooperative research before a jet plane could take to the air, accomplish its mission, and safely return to the ground.

The sum total of advances in the young profession of industrial engineering may well be called considerable. However, it seems that the industrial engineer, generally speaking, has assumed a position of isolation, that is to say that he appears to profess his ability, by himself, fully and competently, to engage in his problem-solving activity without, on the one hand, progressively enlarging his knowledge in his own field, and on the other hand, without enlarging his knowledge of related fields, at least to the point where he may understand fundamental realizations, and apply them effectively to his own sphere of activity, and without running the risk of introducing into his 'tool kit' unfinished theories, or untested systems, and cause eventual harm in his industrial environment by the misapplication of such untested methods.

One consequence is, of course, the loss of certain fields to other professions because of the industrial engineer's failure to deal with certain problems effectively and to the satisfaction of those who are concerned with, or involved in, the problem. Examples in this category are: (1) Job Evaluation, long thought of as being in the domain of the industrial engineer, yet having little objectivity about it. When job evaluation plans were investigated by industrial psychologists[1] who were able to deal with the subject in a far more objective, and in a quantitative manner, a considerable contribution was made to job evaluation by gaining more fundamental knowledge of the functional relationships, and thus being able to evolve a simpler, more reliable, and operationally verifiable methodology of job evaluation. (2) In the case of Statistical Quality Control, which for some time, seemed to be sliding away from under the industrial engineer's seat, primarily because many men lacked the necessary training, and because it took the schools a while to readjust the curricula to the new need. And (3) in the case of Operations Research where workers in the basic sciences translated the concepts of basic research to rather typical industrial engineering problems, applied them, and came up with quantitative bases for decision—and were successful.

The 'return home' is well evidenced by two writings by Professor George E. Kimball. In METHODS OF OPERATIONS RESEARCH[2] he refers to the industrial engineer as 'efficiency experts', and one gains the impression that the belittlement originates either from their ignorance of industrial engineering which would be difficult to believe, or from a far reaching study of the advancements in industrial engineering. However, Professor Kimball recently published a paper INDUSTRIAL OPERATIONS RESEARCH[3] where he credits industrial engineering (and applied economics) as having made "a great deal of progress". Others in Operations Research, having an eye for the future, are viewing their activity as a branch of industrial engineering. It must be realized, especially by industrial engineers, that loss and limitation are in direct relation to our own amounts of knowledge and competence.

One of the significant aspects of these examples where rich fields of activity may tend to slip away from the industrial engineer is that the methodologies which had been employed by industrial engineers to solve the classified problem were displaced by other methodologies. Examination of the methodologies, the old ones and the new, discloses clearly the trend toward more objectivity, a replacement of subjective evaluations by objective evaluations, and the foundation of judgment upon quantitative analyses rather than upon qualitative opinions. To accomplish this, we often lack fundamental knowledge. Those from other fields were able to draw from knowledge in their own fields and analogously apply techniques already proven useful in their own fields usefully to industrial engineering problems.

Progress may be defined as the sum total of small advances in a professional field over the entire period of its existence. The individual advances, each by itself, may appear to be of little significance; however, reflecting upon the universal, cumulative pool of knowledge in a professional field one may well realize the magnitude. Although the rate of growth has been rapid, and has led to a wide acceptance of the principles of industrial engineering in many fields of human endeavor, the practice has been rejected in a number of quarters, has been merely tolerated in others, or is regarded with an appreciable degree of skepticism. Concepts, methodologies, systems, etc. are accepted, or rejected, because of enthusiasm, because of fear, or any number of emotional causes, or combinations of causes. A methodolgy may be successfully applied (generally accepted) in one plant, and completely fail (generally rejected) in another. Viewing the industrial engineering profession as a problem-solving function, we begin to ask: Why do systems fail? The authors do not have the answer to this

1. Lawshe, C. H., Rogers, R.C., and others.
2. Morse, P. M. and Kimball, G. E. METHODS OF OPERATIONS RESEARCH, Technology Press and John Wiley & Sons, New York, 1951
3. American Management Association, Manufacturing Management Series #200, New York, New York, 1952

question. Nor is it believed that there is *one* answer.

As a matter of fact, it is a strong conviction that one of the reasons for such failures lies in the attitude of the problem-solver who carries out his work in a conceptual frame of reference which we have called the 'either-or' orientation, the choice-of-two attitude.[4] As soon as we learn to reframe our thinking to at least a multi-valued, and preferably infinite-valued orientation we begin to grow increasingly more cautious to suspend our judgment, and to rephrase our references to quantitative, rather than qualitative, decisions. This process might be called objective. It is often referred to as being 'scientific'. We are careful to impress the reader that while much of the problem-solving activity in this field proceeds in fact on a sub-scientific level, the profession of industrial engineering must finally rest upon the application of scientific knowledge. The verification and validation of industrial engineering methodologies, etc. fall into the province of the engineer-scientist. The approach to such validation may well be similar to the approach of the researcher to problems in the basic sciences. Today's researcher does primarily two things: He builds a model—and he tests the model. The scientific model is the physical construction of the idea; it must be rational, reasonable, and it must meet the rigorosum of experimental test. Above all, the hypothesis must predict to a high degree of reliability the results of the experiment which was designed to test it.

A further realization — if we have learned anything at all from the advances made in other fields—is that (1) the sum total of universal, pooled knowledge in industrial engineering has remained too small to develop tools for effective application in the field, and (2) that the relationships and intra-relationships which the industrial engineer encounters in a complicated industrial and business society require solution through methodologies outside of the professional field of industrial engineering.

During our exploratory work it became quite evident that the psychological and sociological aspects involved in the problems which industrial engineers attempted to solve were of such complexity that we became aware of our own limitations without enlisting the collaboration of specialists from other fields. Another important fact must be understood: The members of our profession are apt to get rather unhappy when their work and purposes are misunderstood, when we are, for example, identified as 'effiiciency Experts', etc., yet, we commit similar offenses in relation to others. In our observations, the semantic reactions of industrial engineers in practice to activities such as industrial psychology, industrial sociology, etc. appeared to be quite similar to the semantic reactions of non-industrial engineers to industrial engineering. We fail to see that, for example, psychology has long ceased to be a philosophy of the Sigmund Freud pattern, but rather has come to evaluate phenomena in quantitative terms. The same is true of industrial sociology. The results of sociological inquiries can be expressed in definite quantities using the same type of advanced mathematical thinking which has produced Statistical Quality Control, and which Davidson, Nadler, Lehrer and others have employed in solving industrial engineering problems, and in determining causalities of phenomena in order to evolve methodologies which can find practical application by practicing industrial engineers.

Another realization is that most new concepts in industrial engineering soon fell victim to commercialization, and it often appears that had more time been taken in development, verification and validation, many individual advances could have yielded considerably more basic knowledge, and consequently more lasting contributions of greater usefulness. Based upon our knowledge of the effectiveness of collaborative research in other fields of endeavor we began to look for sources of collaborative research in industrial engineering. Our search has yielded little.

Our search indicated that there were individual researchers, who were conducting basic and applied research in specific phases of management, however, their work was done in obscurity and without the support and strength which comes with organized, coordinated, collaborative activities. It was, moreover, soon found that a large degree of mutuality existed between such individual researchers, and that the organization of this group was welcomed by those who were far sighted enough to realize the advantages of, and the need for, this type of organization.

Following this general criticism of the inadequacies of industrial engineering, it must be admitted that no worthwhile progress can be made without such self-criticism, and without recognizing to some degree the shortcomings. We may then have a starting point for improvement.

A listing of Areas of Research is in preparation. Some of these may be thought of as "basic" research, and it is understood, of course, that one cannot project results which are expected to be yielded from such projects; as a matter of fact, one hesitates to expect any yield until such work is well along its way. Other areas fall definitely into the classification of 'applied' research and results will definitely be forthcoming. Several projects are already under way. The Methods and Standards section of the Industrial Engineering Department of the Ohio State University is conducting an inquiry on The Equivalence of Different Perceptual Stimuli in Rating.[5] This investigation is being conducted by Richard W. McGuire, formerly a faculty member at Georgia Institute of Technology, now a Research Fellow at the Ohio State University, and one of our Research Associates. Although this research has not, as yet, been brought to completion, the following report on McGuire's work may be made at this time:

There has always been some means of recognition of individual differences in the operators which perform the industrial operations. The problem was initially met by means of personnel selection which in Taylor's case was the choosing of the "first class" man for the job. Disciples of this system attempted to follow its pattern but through the course of time one finds greater deviation from the original conception. Variations in production rates were the rule rather than the exception and many reasons were given to explain this variance from the standard set by time study. The first real contribution to this section of the field of time study was made by Lowery, Maynard, and Stegmerten when in 1927 they made public their system of "leveling."

Leveling attempted to convert the times observed by the time study man to those which would represent those of the average operator, or more specifically, to those which would be compatible to the definition then existing of a normal time. This was done by taking into account factors which were supposed to cause the individual differences. An algebraic summation of one plus the percentage assigned to each of these factors for the given job, resulted in a rating or leveling factor which when multiplied by the selected time from the observed times, resulted in the normal time. Variations from this method have evolved in the past thirty years, but the end result of obtaining a rating factor by which the selected time must be multiplied, still remains.

There may be objections from some quarters of the field to an investigation into the subject of rating, on the basis that synthetic time standards are a more advanced methodology of setting rates; hence, the stop watch technique is rapidly becoming outmoded. To this it might be pointed out that the primary objection to the stop watch technique is the use of qualitative judgment. Although the proponents of synthetic time standards say that rating is eliminated,

4. Korn, K. T., MANHOOD OF INDUSTRIAL ENGINEERING, RCOSTS, 1951

5. McGUIRE, R. W., THE EQUIVALENCE OF DIFFERENT PERCEPTUAL STIMULI IN RATING, a forthcoming RCOSTS publication.

other objections were found to the systems which are worse than the objections raised against the conventional methods of time study. In order to substantiate this point attention is called to the facts that (1) the data upon which synthetic time standards appear to be built are insufficient, (2) a rather large amount of qualitative judgment enters into the compiling of all systems of standard data, (3 the known systems to date, differ markedly both in end result as well as basic proportions, and hence all cannot be correct, (4) judgment and individual differences are still present at the application level.

Because of these facts it is believed that the stop watch technique should not be sold short for questionable new methods, but that we should improve that which exists until such time as it meets the criteria set forth for it, or a methodology is proposed which meets the criteria. By this reasoning we felt justified in initiating investigations such as those described here.

McGuire reasons that it is frequently the case that data secured to arrive at a given question, may well be used for the investigation of other similar questions; we will find this to be so in this case due to the design of the experiment. Although the primary question of the experiment is concerned with the equivalence of two stimuli, it would be well to know the relationship and interactions of the various factors contributing to, or being primarily involved in, the end result. First and foremost, we wish to determine the equivalence of two entirely different stimuli; one is tridimensional, is possessed of sound, is clothed in reality; the other one is bi-dimensional, is artificial, and is foreign to the previous stimulus. There are particular factors which must be brought together to produce both of these. The film is directly dependent upon the existence of the actual operation, while the actual operation is dependent upon the existence of the job and the operator . . . the ratings of both are dependent upon the observer. This gives us four variables with which we must work simultaneously . . . the stimulus, the observer, the operator, and the operation.

Statistics offer a very convenient tool for handling multifactor designs . . . the analysis of variance. By means of this technique we are able to get variance estimates of each of the multi-classifications and their interaction with each other. An application of the F test enables us to calculate the level of significance of each combination. With such a useful tool at hand McGuire decided to design his experiment around this technique; hence, the basic form of analysis will be the complex quadruple classification of the analysis of variance.

For observers in the experiment, twenty advanced Industrial Engineering students who had had previous industrial experience were chosen. Their status was considered as being inadequate without further training in all aspects of the matter of rating. A program was outlined so that the group received a balanced schedule which contained theory, rating practice on films as well as actual operations, and tachistoscopic training. Tachistoscopic training is a technique developed by Dr. Samuel Renshaw to increase the perceptual abilities of the individual; and has proven very successful in actual application, when used by the Army and the Navy as well as by several industrial concerns. Basically, the technique is a means of short time exposure (one hundredth of a second) of a stimulus in order to force the individual to see the stimulus as a unit or whole; by gradually and systematically increasing the size of the stimuli, the subject is forced to perceive larger and larger units. The entire program was projected over a three month period so that at the end of that time, the observers were trained to a degree far beyond that which the college student normally receives rating training. Following the training, the group was divided into two equally matched groups such that the sub-groups were matched as to total ability and individual ability.

The next step was the selection of a stratified sample of jobs which met the following series of criteria: (1) the ratio of man time to machine time was high, (2) the time length of the cycle was relatively short, (3) the operation was man paced not machine paced, (4) at least four well trained operators who normally perform the task, be available for observation, (5) the jobs selected represent a rather wide latitude of job types from heavy manual jobs to intricate dextrous operations. Twenty-three operations were selected from industry which met these criteria thus yielding ninety-two operator-job combinations.

These operations were rated by sub-group "A", while simultaneously being photographed; Sub-group "B" would rate the film. This process was reversed on the next operation; that is to say, sub-group "B" rated the actual operation so as to act as a check and balance against any defect in matching. Through this procedure each sub-group rated an equal number of actual operation and film.

Once the data was gathered it was arrayed in the post, column, line and layer form to lend itself to statistical analysis. Standard deviations of each of the operator-job combinations were computed, and graphical analyses of these were performed. The films were analyzed for cycle times, fumbles, and motion patterns. At the date of this writing, the complete statistical computations have not been made and therefore the conclusions drawn will not, in any manner, be complete but will merely be an indication of the trend of the data thus far analyzed.

It may be concluded that:

(1) The variability among observers is not a constant, and is generally higher than the 5% generally quoted.

(2) The variability mentioned in (1) is not primarily attributable to such factors as methods differences, fumbles, degree of productivity, etc., but seems to be correlated to all in some minor amount. To properly determine this, a multiple correlation analysis would be necessary.

(3) In most instances the agreement between film and actual operation rating means is surprisingly close. The significance of any differences cannot be told until a complete set of statistical computations are finished.

(4) The general belief that an observer having a conception of "normal" can accurately rate any operation, is not up-held by the data thus far analyzed.

It is to be noted that McGuire constructed his experimental design around the statistical methodology of the analysis of variance, a tool supplied by the mathematician which has found many applications to prove its usefulness. It was also noted that he used the tachistoscope for perceptual training of the observers, a device developed and designed by a psychologist[6] and the usefulness of which had already been amply demonstrated. We believe this to be one example of cooperative research in Industrial Engineering and we are confident that, once completed, McGuire's work will yield important additions to the universal pool of Industrial Engineering Knowledge.

A second important project has been explored by Harold O. Davidson[7] and the results of which are available in his forthcoming publication.[8]

This work is neither a handbook nor a text on how to make time studies. The author has no favorite system to expound but rather attempts to present an integrated perspective of the field of time study—past, present, and future. A final hundred pages are devoted to reports on a number of research studies conducted by the author and his associates.

The interest of some readers may be drawn primarily to the specific results of research reported by the author. It would seem to the reviewers, however,

(Continued on Page 18)

6. Dr. Samuel Renshaw—Ohio State University.
7. Dr. Davidson is in charge of graduate work and research in the Methods and Standards Area in the Department of Industrial Engineering, The Ohio State University. He is also serving as an Associate Director of Research on the Research Committee on Synthetic Time Systems.
8. Davidson, H. O., FUNCTIONS AND BASES OF TIME STANDARDS.

PRODUCTIVITY, HERE AND ABROAD

Speech by Ewan Clague

COMMISSIONER OF LABOR STATISTICS,
U. S. DEPARTMENT OF LABOR

Before the Second Annual Convention of the American Institute of Industrial Engineers, Cleveland, Ohio, June 16, 1951

Basically, productivity is the relationship between *input* (expressed in terms of manpower, capital investment, machinery applied in production, electric energy, mechanical energy, or other forms of power, or various other factors) and *output*, expressed in terms of physical units, in dollar value of production, dollars of sales, or value added by manufacture. We in the Bureau of Labor Statistics have found that the most manageable productivity measure, and the one which is most nearly comparable from industry to industry, is the relationship between *physical man-hours worked* and *physical units of production*. This relationship may be expressed in terms of the level in any one period, or in an index expressing changes over a period of years.

Productivity measurements may be expressed in any of a number of degrees of scope and exactness—ranging from the intangible but comprehensive expression of gross national product per capita to the precise engineering time analysis of man-hours required to perform one specific operation in a particular factory. The Bureau in its various programs now carries out different types of measures which can bridge the vast gap between these two extremes—(1) the *general industry index* of output per man-hour based on secondary-source materials, which is within reasonable distance of the gross national product measurement; (2) the *direct report* of trends in man-hours expended per unit of product which, like the general industry index, provides information on the average trend for a segment of industry, but in addition provides details in terms of individual products, processes, or factory departments, for both direct and indirect labor; and which relates productivity trends to important factors affecting productivity, such as production method, technological change, utilization of plant capacity, etc.; and (3) a new program of *case studies and factory performance*, which provide one-time analyses of factory productivity in the manufacture of specific products, in terms of processes or departments, and also for all of the major individual occupations within each department—thus approaching the detail provided by the industrial engineer's time-and-motion study.

A nation's productivity is unquestionably one of the two major determinants of the way of life of its people. The other, of course, is the sociopolitical system under which the nation is governed. During the past century or more most of the advanced industrial nations have established democratic social and political systems. However, no political system, no matter how liberal and democratic it may be, can yield a high standard of living for the people unless the economic system of producing goods and services is productive and efficient. The American people are blessed with more goods and services and more leisure time than any other nation, but this is not due solely to our vast natural resources. There are other countries which are more richly endowed than we are. The American standard of living is due to the development in this country of a high rate of productivity which exceeds that of any other country in the world. In other words, the land and the other natural resources were put to good use by an enterprising and productive people under a system of political democracy.

Relatively little accurate, comprehensive and up-to-date information is available to compare American and European productivity on comparable products from industry to industry. The Bureau is now working on studies which may in time lead to the development of more complete information of this type. Such information as we have, however, gives conclusive indications that in general productivity is much higher here than abroad. In most industries, United States productivity outstrips even the most advanced countries in Europe in a ratio of three or four to one, and more in some industries. This great advantage is due in part to our more advanced technological (machinery and equipment), in part to our technical know-how in production, in part to the large scale of relatively standardized output in most U. S. factories (as compared to the typical European plant), and to many other more intangible factors as well.

Although the U. S. has a lower productivity than some industrial nations of Europe in a few industries, the predominant pattern is one of great American superiority, in some cases as much as five or six to one. This means simply that American industry economizes on labor to a degree unknown in most other industrial nations.

For several decades prior to World War II productivity in the U. S., as measured in output per man-hour of labor, increased at a rate of from two to three per cent per year. The exact figure is not available, and in many cases even an approximate figure depends in part on the kinds of industries included in the measurement. For example, in manufacturing the rate is nearer three per cent; in agriculture it would hardly be that high; in certain types of consumer service industries no adequate measurement has been made. Since the beginning of World War II productivity in the U. S. has risen to new high levels, but the rate of increase is considerably below three per cent per year. This is partly due to the fact that industry was greatly dislocated and disorganized by the war; first, in the conversion to war production and later in the reconversion to peacetime industry.

In Europe, productivity suffered greater losses during the war than in the U. S. In some countries like England, the conversion to war was more complete. In other countries like France, Germany and Italy, there was considerable war destruction, to say nothing of the failure to maintain a satisfactory rate of new capital investment. Recent evidence indicates that there was considerable improvement in productivity in many European countries during the period 1947-50.

The question arises as to why there should be such basic differences in productivity and living standards between the U. S. and Europe. Some of the reasons ordinarily given to explain these differences are not valid. For example, the differences are not due primarily to the inherent wealth and resources of the U. S., although this nation does have vast natural resources. Nevertheless, many Europeans attribute the differences to this one factor—a misconception which is doubly harmful; first, it is not as important as the Europeans think; and second, it weakens their incentive to improve their own productivity.

A second prevalent misconception is that these differences between the U. S. and European countries developed overnight, that is to say, since World War I perhaps. This is not true; these differences have grown steadily for over a century and a half, with particularly rapid growth during the past half century. The differences are due to some-

thing more fundamental than the losses a nation suffers in war.

There are sound and solid reasons for the productivity advantage which the U. S. has obtained. These can be summarized in the following points:

1. Early development of a mass market, based on the demand for goods from a growing populace, the widespread application of the principle of interchangeable parts, and the application of power and machinery to standardized production, rather than limited-volume craftsman-type production.
2. General and widespread application of capital investment on a large scale for the latest and most efficient types of production machinery and equipment; flexibility in applying capital; imagination and open-mindedness on the part of those applying the capital; with willingness to change or replace old equipment with new and different types; encouragement of experimentation.
3. Rapid development and continued growth of alert management; steady pressure of competition; strong initiative on part of business and management, seizing of opportunities for expanding markets; early awareness of the importance of leadership, and adaptability to change.
4. Development of individual initiative and a sense of participation on the part of industrial workers; adaptability to changes in production methods; development of basic business-like attitude on the part of organized labor, with participation in the development of improved techniques, sharing in productivity gains; encouraging technological advances.
5. Development of production engineering and scientific management engineering; participation of industrial engineers in planning and organizing for efficient, low-cost, high-productivity output for a mass market. Development of close relationship between product engineering and production engineering, with adaptation of products to conform to requirements of efficient manufacture without sacrifice of quality.
6. Development of industrial research on an organized basis for improvement of efficiency, development of new ways of making better products more efficiently. Note that this phase is at the present time in a state of rapid growth and increasing importance.
7. Development of large-scale advertising for the purpose of building and shaping consumer requirements, as a means of making possible mass markets for goods and low prices for quality merchandise.

The significant developments sketched above in summary fashion have led to profound changes in the American production and marketing system. A partial list of these changes is as follows:

1. Improved technology and work techniques.
2. Lower unit costs.
3. Broader market and increased volume.
4. Lower prices.
5. Larger return to capital, encouraging new investment and making possible more engineering and research.

These trends are in sharp contrast to the prevalent tendencies in the industrial countries in Europe. There the usual practice is low-volume controlled production for a limited market, with high unit costs, low wages, and resistance to change or technological improvement because of the fear of technological unemployment or the failure to spread the gains of increased productivity throughout the population. The result is that neither labor nor management in the countries of Europe have the same interest in productivity that is found in management and labor groups in the U. S.

The problem for Western Europe is that of creating circumstances and incentives which will make possible a marked increase in productivity. The standard of living in these countries has not risen appreciably since prewar years. A magnificent job has been done in restoring industry to prewar production levels. On the other hand, these countries are now faced with the necessity of increasing their armaments for defense. This means that the armament program must compete with the standard of living of the masses of the people. The only long-run and sound solution for this situation is a sharp and continued rise in the productivity. If this can be achieved it should be possible to increase armaments and at the same time to raise, at least to some extent, the standard of living.

The U. S. has made a number of important contributions to this productivity. The Marshall Plan provided funds to restore prewar production. The Economic Cooperation Administration program was attempting to make American productivity experiences available to European countries. One important point is to have the peoples of Western Europe understand the reasons for high productivity in the U. S. and to learn how to apply American experiences to their own individual industrial systems.

Formation of Local Chapters

Prepared by Chapter Organization and Extension Committee

As members of a fast changing and growing profession, industrial engineers must work continuously to keep pace with the field. Perhaps the most effective yet pleasant way of doing this is to participate actively in the affairs of a local A.I.I.E. Chapter. The national A.I.I.E. organization recognizes this and is thus anxious, in every way possible, to assist its members in the formation and maintenance of new chapters.

Study the following list of benefits of the local chapter. Consider how these will enrich your personal and professional life; how they will assist you with your work; keep you informed and insure you a top secure spot in your field and in your company.

Professional Contacts

The opportunity to meet frequently with other industrial engineers in the community to discuss and work out common technical problems.

Technical Sessions

The opportunity to plan and present programs consisting of papers, debates, panel discussions and forums.

Visitations

The opportunity to arrange and attend plant inspection trips to view industrial engineering techniques on the job.

Committee Work

The opportunity to follow specific problems of company or personal interest with the assistance of fellow members.

Technical Expression

The opportunity to prepare and present technical papers to express one's self in open forum, to cooperate on interesting research projects.

Professional Leadership

The opportunity for experience in conducting the work of others through committee chairmanship, round table leadership, or as a chapter, regional, or national officer.

Social Contacts

The opportunity to expand acquaintances and to meet socially with industrial and community leaders with the strong common bond of mutual professional interests.

Job Opportunities

The opportunity to learn firsthand of openings and job transfers within the industrial engineering community, plus the opportunity to meet and appraise prospective employers (or employees).

Salary and Promotion Data

The opportunity to survey and appraise salary and promotion policies and practices in the community.

Professional and Vocational Guidance

The opportunity to receive guidance

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FATIGUE AND TRAINING

. . . by A. B. Segur, A. B. Segur & Co.

As presented to the American Institute of Industrial Engineers, National Convention, 1950

One hears much about both fatigue and training. Few people seem to realize that the factors that control both are very similar. This paper will deal with their common relationship.

When considering fatigue the term should not be confused with fatigue allowances. Many fatigue allowances have very little to do with fatigue. The standards department has learned that they cannot use their time observations to determine pay without an adjustment factor. This factor is given many names. One of these is fatigue.

The factor applied depends entirely upon how the observation is taken in the beginning.

Suppose we consider a hypothetical case. A man or group of men are following a method of operation more or less consistently. A foreman times them for two hours. His production figures show 268 pieces produced per man in two hours. He adds 18% to the production to obtain the expected production. He says, therefore—

$$\frac{268 \times 1.18}{2} = 158 \text{ per hour}$$

A time study man observes the time by pieces. His times are as follows:

					Total	Ave.
.30	.39	.42	.29	.33	1.73	.346

He says, I will allow 10% for fatigue and incentive. His figures look liks this—

Our time per piece .346
Allowance .346 x 1.10 = .38
But 60 ÷ .38 = 158/pcs./hr.

A second time study man looks at the job. He makes his study by elements. His figures are as follows:

					Selected Time
.03	.02	.02	.04	.03	.02
.08	.10	.10	.06	.07	.06
.02	.04	.04	.02	.04	.02
.06	.08	.10	.05	.08	.05
.04	.05	.06	.04	.05	.04
.07	.10	.10	.08	.07	.07
—	—	—	—	—	—
.30	.39	.42	.29	.34	.26

He selects the minimum of his readings to give a sum of .26.

He then says—

Fatigue	10%
Personal	5%
Total allowance	15%
.26 x 1.15	.30

He then settles on 27% incentive

$$\frac{.30 \times 1.27}{.38} = \frac{60}{.38} = 158 \text{ pieces}$$

A Motion-Time-Analysis man gives a detailed description of each motion on the job. His description is so accurate that no man could follow the description and fail to get the proper result. He uses no watch. He simply applies standard times to each motion. When he finishes he has 20 pages of written matter. His answer is .212 Min.

The chances of an operator beating this time at the start are very remote. On the other hand, practically all qualified operators will equal the time for a portion of the cycles.

When operators are controlled so closely even the qualified operator will make mistakes in the method of performing the majority of the cycles. The number of mistakes made will depend upon how much the attention of the operator is divided during the operation. Therefore we always add from 5% to 30% to the base time to allow for these inevitable errors.

In addition, we add 10% for fatigue and 5% for personal. The actual requirement for these factors varies with every operator. In the beginning we made these two allowances because others were making it. Through the years of performance the operators has seemed to justify these percentages.

Mistakes	20%
Fatigue	10%
Personal	5%
Total	35%

Then .212 x 1.35 = .286

This represents the average time of the expert operator. Therefore all incentive must be added. He therefore allows for incentive, 33%.

$$\text{Therefore } .286 \times 1.33 = .38$$

$$\frac{60}{.38} = 158 \text{ pcs. per hour}$$

Many people have undertaken research to reduce fatigue to exact allowances. So far we know of none that have succeeded. One of the best treatises on fatigue is "The Human Motor" by Amar. This book contains much valuable information on the general subject. But Amar found a wide variation in endurance between individuals. The remainder of this paper will attempt to explain why such studies are so difficult.

Fatigue is of two types—physical and mental or nervous. Physical fatigue expresses itself in heavy oxygen consumption, in muscle strain, in excessive action of the waste organs, in a tearing down of the bodily organs. Nervous or mental fatigue expresses itself in a different way. There is a trembling of the muscles. The aim or timing of the body is not so accurate. The operator becomes dull. Interest is lost in the work done or the surroundings. On the other hand, inhibitions are lost. Talk may become loud. Foolish laughter takes the place of calm decorum.

There are very few jobs indeed nowadays that lead to excessive physical fatigue. The signs of such fatigue are too evident. Jobs where work is done under excessive heat or cold are good examples. Still cleaners in the oil refining industry formerly worked in temperatures as high as 450° F. Now these workers seldom work in temperatures exceeding 225° F. Means have been found and are constantly being improved for cooling the stills. Blast furnaces were formerly charged by hand. Mechanical men now take their place. Foundry molders formerly carried out all molds. Conveyors are taking their place more and more. Atmospheres of dangerous gases are being cleaned constantly. The prevention of hernia is under constant study. Perhaps one of the last hernia producing industries to be humanized is now the bricklaying trade.

The existence of mental fatigue has not been so easily recognized. This form of fatigue is very much magnified in the person who has allowed his system to be weakened by dissipation. The excessive use of narcotics and alcohol can nearly always be distinguished by the quick nervous fatigue of the subject. Many strikes have been caused by the fact that a portion of the workers were suffering from some form of nervous fatigue.

A great deal of what is considered muscular fatigue is really nervous fatigue. In order to understand this type of fatigue we must consider some simple physiology. Each of you know that each movement of the body is the result of muscular contraction. Each small muscle fibre (sarcostyle) is a unit in itself. If the load is very heavy many sarcostyles pull as a unit. If the load is small only a few act at any one time. Each muscle fibre pulls full distance of which it is

capable when once it starts to pull. The movement caused by any one sarcostyle is very short. The average body movement is really a rapid succession of movements of sarcostyle units.

Each sarcostyle consists of a short fibre. At each end is attached a small tendon. At the side is attached a nerve ending. The nerve fibre (ganglion) leads off from the sarcostyle. The impressions to the nerve ending come from the brain. The sarcostyle cannot contract unless the order comes from the central nervous system. Where the muscle contracts lactic acid is created in the neighborhood of the muscle fibre. Under normal circumstances this lactic acid is oxidized by the lungs. If it is created too rapidly at any one point it cannot be carried off rapidly enough. The lactic acid then attacks the nerve endings. The orders cannot reach the muscle fibre. The fibre acts improperly or not at all. Fatigue has taken place.

Suppose we consider a very simple test. This is known as the tapping test. Provide a simple table or desk at normal writing level. Provide two surfaces with a difference in elevation of from one-half to one inch. One is a sound-deadening surface such as paper or felt. The other is a sounding surface. The subject holds a simple tool, such as a knife or the wooden end of a lead pencil. The subject gets himself set. He then strikes first the deadening surface and then the sounding surface. This is repeated at the operator's best speed. The speed must not be less than 29 full taps in .15 min. Keep track of the time at which the muscles no longer coordinate properly. The muscles cannot move from one surface to the other. Or the tapping is manifestly faulty. People generally think in terms of hours for the time for fatigue to develop. Not one person in one hundred can keep up this tapping for 20 seconds. If now this same fatigue takes place near a dangerous machine, the hand is just as likely as not to go to the danger area and a hand is lost. If the controls of a machine are being handled the machine may be guided the wrong way. An automobile crash may take place or production may be slowed down. The more difficult the operation the more chance there is that nervous fatigue will cause difficulties.

Many jobs require close attention and thinking as well as active physical work. On such work any distraction slows production. Mental fatigue makes the operator more susceptible to distraction. The result is a vicious cycle.

Needless to say, the amount of nervous fatigue varies greatly. It varies between people and varies from day to day for the same worker. Manifestly the provision of a time allowance is not the answer to fatigue. The first answer is the elimination of the cause of the fatigue. The next answer is the elimination of the harmful effect of the fatigue.

Many years ago we had the job of training tire builders. In one plant we set up a standard that was 30% higher than the plant had ever been able to ready before. The company decided to test Motion-Time-Analysis training. They assigned to us the man they considered to be the poorest tire builder in the room. To our utter surprise he came up to a full speed on the operation within about three weeks. No one had been able to beat his record. Then we left him. The next day his production was down to his old speed.

It was difficult to find the cause. The man was not loafing. Finally we tried an experiment. At some point in the operation in the building of each tire, the instructor would simply tell him what to do next, nothing more. The production went up to his top standard. The instructor stopped coaching. The production went down to his old standard. The man could not mentally concentrate for the time required to build one tire. The concentration was broken up. Full speed was the result.

You will find many operators of this type. Many times the use of a metronome, the regular click of a piece of machinery, an understanding word of encouragement from the boss, anything that will bring the operator's mind back to the job in hand will take away the nervous fatigue and will restore production.

Today, on manufacturing operations, at least 80% of all fatigue is nervous fatigue. If you attempt to take care of nervous fatigue simply by allowances you will probably reap low production, dissatisfied personnel and labor difficulties. Put yourself in the place of the operator. Remember that you sometimes get tired and bored also. Think the job through first. Arrange the job so that you would like to do it if you were the operator. Do not depend upon the operator trying to figure out just what you meant when you designed a piece of machinery. Tell them what you mean and then be willing to accept the responsibility for the method you have designed. If it is wrong, be willing to admit that you made a mistake.

When the operator is being trained do those things to aid and instruct the operator that you would want done if you were the operator. Remember that disciplinary fatigue and nerve fatigue are real problems. Do those little things that would bring back your interest if you were bored. The pay envelope is important, but other things are important in a plant also. If you will remember these things your company will reap the benefit that goes with higher production and better labor relations. You can stand back and look at the job you have done and have some sense of professional pride.

Work Methods and Work Management Clinic

Sponsored by the Dayton Chapter
May 8th and 9th

Increasing production efficiency by methods improvement, work measurement, and wage incentives will be the chief subject of a two-day clinic sponsored by the Dayton Chapter of the American Institute of Industrial Engineers in Dayton, Ohio, on May 8 and 9.

Dr. Ralph M. Barnes, Professor of Engineering and Production Management at the University of California and Western Vice-President of A.I.I.E. will conduct the sessions.

Dr. Barnes is internationally known for his work in the field of industrial engineering. He is the author of texts which have become standard reference works in time and motion study, work simplification, and related subjects. For ten years he has conducted the famous summer management course at the University of Iowa. He has maintained his contact with the practical problems of industry through his work with industrial organizations all over the United States.

Subjects covered in this intensive course will be: Objectives of Industrial Engineering, Motion Study and Its Tools, Methods of Increasing Worker Productivity, Process Analysis, Equipment Utilization, Design of a Methods Training Program; Work Measurement, Time Study, Elemental Data, Motion-Time Data, Performance Rating and Accepted Practice in These Fields; Fundamentals of a Successful Wage Plan and Why Some Plans Fail. Those attending will also have an opportunity to participate in Dr. Barnes' work measurement survey.

The clinic is designed to provide a realistic and practical program for industrial engineers, plant managers, superintendents, foremen, time study and methods men, cost accountants and office executives.

Information regarding the clinic and the 1952 National Convention of the American Institute of Industrial Engineers which follows on May 10 may be obtained from R. E. Allen, Univis Lens Company, 401 Leo Street, Dayton 1, Ohio.

An Arbitrator's View of Timestudy Incentive Application Problems as Related to Union Contracts

. . . by G. Jay Anyon,

Wharton School, University of Pennsylvania

It is upon those occasions when the Industrial Engineer is asked to justify his decisions and actions that the arbitrator views these phases of the Industrial Engineering Practices in Industry. Taking the liberty to tap a limited universe of experience and to generalize upon it, at this time, the aspects that stand out in bold relief are as follows, cast in the form of questions:

1. How has the technical phase of work been done? Can it withstand the challenge and onslaught of criticism?
2. Has there been the recognition of the human element involved in the work done? What is the impact of the action taken upon the acceptability sought?
3. Has there been a proper recognition and evaluation of the institutional forces at work in the situation? What is the effect of the action on existing patterns?

In answers found to each of the above questions (there are others not now to be discussed), are established the determinants that create the issues and the substance of Collective Bargaining over Industrial Engineering practices related to Timestudy and Incentive application.

Once the Industrial Engineering practices are brought within the scope of Collective Bargaining the Industrial Engineer is bound by the contractual obligations stipulated. As an Industrial Engineer he has given, in an "a priori" sense, some of the "laws of the situation" that he must take into account in his work.

To review some of the experiences in relation to each of the identified aspects, in as succinct a manner as possible, the most prevalent will be identified.

1. In regard to technical phases of work the following has been observed:
   Where all elements and/or conditions are not under adequate control, adequate allowances are not made to absorb the incidence of occurrence of the uncontrollables. The production study as a timestudy technique often is not given its proper place in the methodology of the Industrial Engineering Dept. Too much reliance is placed on an additive accumulation of job studies' data.
   The statistical nature of timestudy, and the fact that the study made is a basis for prediction is not always sufficiently recognized. The necessary steps are neglected to accomplish an approximation of a "natural distribution" of occurrences inherent in the "law of large numbers." Where the "law of economy" does not permit the number of observations to accomplish this in the most direct manner, the necessary precautions that can be taken to establish a sound judgment upon which to "normalize" the data are often neglected. Where care and caution is taken and consistency is achieved the achievement is often undone by the insistence upon the results being accepted as absolute and infallible. There is often a refusal to accept the results as approximations, and at its best, probabilities within which have not been resolved the problems of individual differences. There have been occasions where the simple rule of thumb, that reflects the statistical nature of the data, has not been acceptable. This rule of thumb—"Is task achieved around 85% of the time and is the best achievement more than twice the achievement of the worst performance?" has upon occasion introduced a sobriety that matches the performance of oil cast upon rough waters.
   The ultimate objective in the incentive application of Timestudy (in its narrowest frame of reference) is often forgotten and neglected. In essence the objective is to accomplish task determinations that establish uniformly difficult tasks throughout the area of application. At this juncture we are back to the first point raised in considering the technical phases of work in the reflection of the operating conditions. Yet, it is an aspect of the application to incentives that is not examined carefully. It serves as one of the best criterion of the technical proficiency achieved in task determination.
2. In regard to the recognition of the human element involved the following has been observed:
   Where a task-incentive design is not in consonance with the cost structure of the given enterprise, pressures are exerted to "squeeze" from the incentive system savings that are nominal, by schemes and subterfuges. The willingness to "go along" on the part of top management is a direct reflection of this one element. It would seem at times that the only savings sought are labor savings even though the greater reservoir of savings accrue from increased volume and the resultant reduction of a high fixed burden on each unit of output. In ignorance of the real source of savings, the machinations to capture more of the labor savings result in a mental set on the part of operators that limits the output (in fear of rate-cutting for example) and thus misses the real source of savings inherent in the cost structure.
   Similarly, where labor costs are a high percentage of cost of production there is often the failure to recognize that in reaching the "incentive level" of activity from the "day-rate level" is the real source of savings even though unit labor costs remain constant. This leads to attempts to tamper with piece-rates that result in the mental set that defeats the whole incentive program.
   At times the same problem is created when the reward is associated with achievement between "what can be done" and "what should be done" that diminishes the incentive to achieve a greater level of accomplishment because of the decreasing rate of reward as greater achievement is attained.
   In other words, the human element is not presented with a task-incentive design and a sufficient explanation of the benefits accruing to each and all of the parties in the situation that eliminate the need for chiseling and soldiering. A willingness to go along is not a propaganda job. Abracadabra and mystery that often is relied upon is usually based upon a failure to fit the needs of the situation in the task-incentive design and an attempt to "force it" through, anyway and/or anyhow. That is, until it "blows-up" in a crisis or emergency that renders the human element an insurmountable obstacle to the entire Industrial Engineering program in the enterprise.
   Too often is the financial incentive plan forced to stand by itself. In the absence of non-financial incentives the psychological impact of financial reward eventually loses its punch. As a result, any difficulties weaken the incentive power of the financial reward offered. Should difficulties

in the task-incentive plan become chronic, the absence of non-financial incentives allows the eventual dissipation of the interest of the people in the entire setup before the difficulties can be worked out.

3. In regard to the institutional forces at work in the situation the following has been observed:

When a financial incentive plan is believed to be a panacea and cure-all rather than the capstan to a comprehensive manegement program the impact on the existing situation can be highly disturbing and volatile.

In some cases the interrelationship of earnings are so upset, throughout the hierarchy of jobs in the area of application, as to defy rectification. In addition to the internal alignment problem the external alignment of job earnings may result in a mobility of labor that can wreck a lot more than just wage-schedules and/or an incentive program.

Very often the task-incentive plan is subjected to a "treatment" that can be traced to the attempt to gain on that "front" what had been lost on another "front" of bargaining between the parties. The reverse is also true, in many cases. Generally speaking, it is apparent that the "Industrial Relations Climate" establishes the type of "weather" experienced by the timestudy incentive program.

The security of the Union and its growth requirements and the security of management and its needs in performance of its functions will be reflected in the behavior of each of the parties in relation to task-incentive plans. Past experience of the parties may often make difficult adjustments to each other in the execution of any plan that otherwise might be made workable.

As a result of such "carryings on" and as a reflection of the relative bargaining power of the parties involved this area of management function has been brought within the scope of Collective Bargaining. The patterns apparent in the way this task-incentive application activity is brought into the scope of Collective Bargaining has been identified along these lines:

a. Mutual consent clauses in the trade-agreement have been established in cases of original installation and in cases of changes to be involved in the administration of a plan.

b. Joint committee clauses in the trade agreement have been used for purposes of installation of a plan, its extension and its administration.

c. Clauses have been written into agreements that establish limits upon the discretion to be exercised in the installation, extension and in the administration of plans. Guarantees in results to be attained have been established in terms of absolute values.

d. Provisions have been established where the "right to grieve" against actions taken include the unlimited use of arbitration before a third party.

There is no place, in this discussion, to establish the right or wrong aspects of these actions. The important thing for the Industrial Engineer to recognize is that the task-incentive program must function within the limits established.

There are two levels at which these limits are created. The first is at the point where contractual obligations are established reflecting the interests identified for themselves by the parties involved in Collective Bargaining. Most often the Industrial Engineer has no part in this activity, directly.

The second level is where complaints and grievances are created to bring into focus a challenge of the interpretation and application of the contractual obligations created at the first level. At this level the Industrial Engineer is right in the middle of it.

When the Industrial Engineer does come upon the scene his role is type-cast for him. He must adjust the "logic of efficiency" that has guided his efforts to the conditions under which it will "prove to be acceptable." His position allows him but one source of flexibility. His flexibility in making his adjustment is tied to his ability to justify his actions. His justification, however, is an element of solution that must be present within the circumstances created by the contractual obligations established by Collective Bargaining.

The more mature Collective Bargaining becomes between the parties involved the more flexibility be available to the Industrial Engineer to contribute to wage determination. However, it must be remembered that there are non-economic factors involved in wage-determination as well as the economic factors. Thereby, the Industrial Engineer and his task-incentive program will never be unfettered. To the extent that in each given situation, the Industrial Engineer in creating his task-incentive program can justify his decisions and actions, to that extent is he creating a constructed force to be felt in wage-determination.

PRESIDENT'S MESSAGE

(Continued from Page 2)

ing the intervals. The responsibility for publishing as well as editing the Journal is now under the capable guidance of F. F. Groseclose of Georgia Tech., and we have every reason to be optimistic for its future.

A number of the standing committees are beginning to hit their stride, and we should soon see some tangible returns from this activity. This is particularly true of the Research Committee on Synthetic Time Systems who have set up some splendid objectives and outlined an ambitious program that should bring credit and commendation to the Institute.

It is regrettable that it was not possible for me to visit more of the chapters, but that is one of the drawbacks and penalties of a growing organization, since a certain size must be reached and fixed obligations met before funds can be available for travel and other activities.

With the firm knowledge that there is a need for the Institute and a growing potential in the field of Industrial Engineering, let us put our shoulders to the wheel and make its future secure. With your continued interest and support there should be no question of the end result.

PROGRAM
AIIE CONVENTION
Biltmore Hotel, Dayton, Ohio

FRIDAY, MAY 9, 1952

6:30 P.M. Board of Trustees Dinner
Dayton Room

7:30 P.M. Board of Trustees Meeting
Dayton Room
Open to all members of AIIE

10:00 P.M. Social Hour. All members of AIIE are cordially invited

SATURDAY, MAY 10, 1952

8:30 A.M. Registration—Foyer entrance to Main Ballroom

9:00 A.M. Program—Main Ballroom
John D. Coleman, Pres. AIEE presiding
Welcome to Dayton—John Farnbacher, Pres. Dayton Chapter AIEE
Report of Synthetic Time Systems Committee, K. T. Korn, Chairman
"Compulsory Arbitration in Basic Steel and Its Effect on Operations and Taxes"—Alfred Treadwell, Jr., Vice Pres. Sharon Steel Corp.

12:30 P.M. Luncheon
Martin C. Miller, Central Vice Pres. AIIE, presiding
Luncheon Speaker — James E. Trainer, Firestone Tire and Rubber Co.
"Management's Responsibility in Manpower Problems"

2:00 P.M. Business Meeting
John D. Coleman, Pres. AIEE presiding

6:30 P.M. Banquet
Introduction and Installation of New Officers
Presentation of Awards
Speaker—To be announced

A Special Program for the Ladies—Friday Evening and All Day Saturday

I E T N O U

Reported by COAOIETNAUF

Stephen Arthur Derry
Chairman

TODAY, the theme is BREVITY. Hence the alphabetical title to the committee's first report. "IETNOU" means Industrial Engineering Techniques New or Unusual. "COAOIETNAUF" means Committee on Application of Industrial Engineering Techniques to New and Unusual Fields.

The committee's objectives are:

1. Tabulate all reported applications of Industrial Engineering Techniques to New and Unusual Fields.

2. Prepare news items for publication in AIIE Journal.

3. Present at the annual meeting, the committee's choice of the most outstanding application of Industrial Engineering Techniques to New and Unusual Fields that came to the attention of the committee.

Among the unusual techniques, developed during World War II, was a new aspect of TIME MEASUREMENTS and practices. These applications to new fields spread rapidly. Today predetermined motion standards, with all of their complexities, are accepted as a modern approach to developing time standards.

Another War II product is the stress on "METHODS IMPROVEMENT" often referred to as Methods Engineering. "MI" or "ME" goes all the way back to the time when Solomon built his temple. Today, the practice has taken on color with the center of attention on the human being. The technique has made many major contributions to the postwar world in the conduct of business and industry. Tomorrow it will make equally great contribution to government at all levels from village through city, county, state, federal and international in its conduct in interchange of business operations with taxpayers and public-at-large.

It is now a recognized fact that "ME" has opened new expressways to the art of managing business and industry through the astounding findings of knowing in advance exactly what men are to do and the best and most economical way of performing a given task which owner, worker, investor, customer and taxpayer heartily approve and welcome as change for betterment. Through "ME" new avenues of approach to the evergrowing problem confronting business, industry and government—HOW TO EFFECTIVELY REDUCE OPERATING COSTS WITHOUT A LOSS OR SACRIFICE—have been copied with amazing success. Many new methods are yet to be unfolded.

Another interesting postwar industrial engineering technique practiced by top level management is a unit known as MANUFACTURING RESEARCH —"MR." Volumes have been published in report form to top management on projects undertaken by the "MR" group. Here are a few recent ones:

International Harvester, through its Manufacturing Research Division, the "MRD" of "IH," since 1947 tackled about 1000 assigned projects. The "know-how" obtained from these case studies brought about an annual saving of $125,000 on just one project, which reduced the car loading time of their finished product from 31 man hours to exactly one man hour per car. This freed more than 140,000 man hours annually for other useful purposes. Many other effective economies ranging from $10,000 to $100,000 annually were revealed and put into practice.

Still another unusual application of industrial engineering technique is what may be called a sister to International Harvester's "MRD." The label on this technique is "OR," which means OPERATIONS RESEARCH. This is also a product of War II.

Operations research employs the ultra-scientific approach—uses higher mathematics—to find quantitative bases for operating decisions. "OR" penetrates into the essential variables of any given situation. These variables are then correlated in a manner which makes analysis understandable by the layman.

"OR" follows a definite pattern. A study of past operations supplies the basic working facts. An explanation of each basic working fact provides data for the establishment of a theory to support the established basic fact. The theory coupled with the basic fact is then used for the determination of a prediction about future operation. The future prediction is then examined as various alternatives are applied in carrying them out in actual practice.

"OR" probably first came into existence at the Engineer School, Fort Belvoir, Virginia, where the effectiveness of equipment and weapons was studied. Other military schools such as the Command and General Staff and the Army War College adopted "OR" techniques in their case studies. The results were very satisfying. It was "OR" recommendations put into practice that put the well-executed German submarine warfare at Bay of Biscay out of business overnight. The counter measures derived through the "OR" technique uncovered the ways and means which stopped the strategy of the Germans.

"OR" recommendations during War II upset many criteria of Maintenance and Efficiency practices in industry. It was the knowledge of "know-how" obtained from "OR" projects during War II that solved the postwar airlift over Berlin.

Some of the applications of "OR" in business and industry today are the study of the uses of machine-controlled recording and signalling devices. It was the application of "OR" and its findings which made it possible for General Motors to announce the new automatic headlight dimmer on the 1952 Cadillac. The findings showed that the automatic dimmer eliminated the human equation of forgetfulness in manually dimming the headlight when a vehicle approaches. "OR" showed that the automatic dimmer, like the Chrysler hydraulic steering, and the universal adaptation of automatic transmission has greatly contributed to the reduction of automobile accidents due to such causes as blinding approaching headlights, steering fatigue of the driver, and time delay in manual shifting. All these improvements have contributed to the ease and comfort of motor vehicle commuters.

Military tactical applications of "OR" found its parallel in business and industry. Today, the principle of "OR" is adopted in solving problems in process scheduling, plant facility utilization, traffic control and material routing. The use of "OR" technique has spread from assembly line application and other factory operating units to fields such as conduct of sales and political campaigns. Note the technique used by candidates for public office. The winner in the current campaign for the high office in the White House may well contribute his success to the proper application of the "OR" technique as it applies in this field. National Cash Register Company, Dayton, Ohio, applies the "OR" technique in training its portfolio salesman. One visit to the classroom of National Cash Register's New York division vividly portrays how the "OR" technique can be applied to sales organizations.

Other nonmilitary applications of the "OR" technique fall into such categories as organizational problems, plant requirement, market research, studies of plant location, and measures of many difficult problems in personnel, labor and public relations.

Some projects now under study where the "OR" technique is applied are as follows:

1. MACHINE TOOL INDUSTRY: Determination of unit cost factors of producers employing semi-automatic multiple purpose machines.

2. COTTON INDUSTRY: Deviation causes between standard and actual costs.

3. TRANSPORTATION INDUSTRY: Measurement of the effectiveness of central control systems.

4. SHOE INDUSTRY: A better fitting of shoes with fewer produced sizes. Also, a better balance between shoe machine operation and shoe machine production.

5. VARIETY PRODUCT INDUSTRY: Effectiveness of budget allocation and distribution of sale promotion locations based on sales analysis.

6. STEEL INDUSTRY: Points in ingot rolling most subject to improvement.

7. PRODUCTION PLANNING: Analysis of policy factor in scheduling production to meet sales forecasts.

8. PRODUCT DISTRIBUTION: Measurement between sales advertising costs and losses due to returned sold goods or products as a result of the advertising.

Many new and unusual industrial engineering techniques will play a major role in solving tomorrow's problems of business and industry. Some of the fields into which the industrial engineer of tomorrow will infiltrate are:

1. LOWERING OF CLERICAL COSTS: Batteries of method specialists are already collecting standards data in clerical operations. Many clerical operations will be replaced by better and more efficient office machines.

The 1952 electric typewriters introduced a new and more efficient typewriter keyboard by placing essential keys at points requiring minimum movement of the fingers. It also eliminated duplication of keys and levers commonly found on manually operated typewriters. The result is better typing output not only in the quality of work, but in quantity with less effort and fatigue on the typist.

This is just the beginning of what is in store for office workers. There will be many innovations in accounting systems, inventory control records, reproduction and calculating machines, filing and record-keeping systems, office furniture, office work-area layout, etc.

(a) PERFORMANCE STANDARDS: Much emphasis will be placed on a closer tie between standard costs and budgetary control which will mean that the industrial engineer will have to apply ingenuity to devising better technique in establishing more accurate standards, and better up-to-date reports. The theme and objective will be in every case —"LOWER THAT COST."

Some solution must be found for adjusting standards to changing fixed costs. The present trend is a constant increase in fixed costs, which will affect break-even points. Management will demand lower break-even points and the task of meeting management's demands will fall on the industrial engineer.

2. CONTROLS: (a) QUALITY: Quality control by the technique of statistical sampling is becoming accepted more and more by industry. However, before it is universally accepted, many changes and innovations will have to be introduced. The field is wide open and a paradise for the industrial engineer who has untapped talents in statistical analysis.

Management will pay more attention to process capabilities, and quality limitation of processes. Management will want more standards in inspection methods. They will want more consistent facts on what is a "good" part and what is a "reject." Consistency in decision will be their objective. It will be up to the industrial engineer to find ways and means to establish the consistency demanded by management. Customer acceptance will set the quality standard more in the future than all other factors combined.

(b) QUANTITY: Output standards for production line workers are plentiful, but the surface has not even been scratched in the area of nonproduction workers. There will be new standards. Many not yet conceived in work areas such as service, clerical, maintenance, sales, engineering, research and "top brass." The reason for this trend is labor costs in the area of nonproductive workers is spiraling entirely out of proportion to the decrease created by the reduction of production employees.

3. COST ANALYSIS: No longer will management cope with the accountant's paper reports on cost analysis. Pressure will fall on the industrial engineer to come up with new approaches to fast cost analysis.

4. INCENTIVES: Today, management is strictly set on a "PROFIT ECONOMY STRUCTURE." The money inducement is the basic factor in all incentives. The feuding, and inequalities, created by present-day incentives will be greatly eased by more widely chosen financial incentives. There will

(Continued on Page 18)

ALPHA PI MU*

From a group of nine students at Georgia Tech who formed the original chapter in 1948, Alpha Pi Mu, the national industrial engineering honorary society, has grown to ten chapters and 798 members. There are chapters at the leading schools of industrial engineering and other chapters will be formed as the students organize and other schools become accredited in industrial engineering.

With this growth, Alpha Pi Mu becomes an important organization in the promotion of industrial engineering. Through its publications and alumni program, the society can materially aid in gaining further professional recognition and status for the profession of industrial engineering.

Last year, through the efforts of Dr. Paul N. Lehoczky, the past national president, and Jim French, executive secretary, Alpha Pi Mu was granted associate membership in the Association of College Honor Societies (ACHS), the recognized group for maintaining the standards of honor societies in American colleges. We are ineligible for full membership as that now requires ten years of active existence as a national society. This recognition of industrial engineering adds to the importance of the IE curriculum in the engineering field.

Chapters are limited to those schools which have an industrial engineering curriculum accredited by the Engineers Council for Professional Development. Each prospective chapter must be voted on favorably by the existing ones. To be eligible for election, an industrial engineering student must be in the upper third of his class if a senior or the upper fifth if a junior. Several chapters have established more restrictive scholastic requirements such as a smaller proportion of the class or a minimum average. The personal requirements are leadership, ethicality, sociability and breadth of interest.

Although the students now make up most of the membership, provision has been made for election as alumni members, those who would have been eligible for membership if the chapter had been in existence at their school when they were in attendance. Outstanding industrial engineers and IE faculty members may be elected to honorary membership. Graduate students can become active members.

At the latest report in March, 1952, Alpha Pi Mu had initiated 650 active, 93 alumni, and 55 honorary members.

At the biennial convention held at

(Continued on Page 18)

*R. M. Eastman, Associate Professor of Industrial Engineering, Georgia Institute of Technology.

Pace Rating In Work Measurement

... by Phil Carroll

PROFESSIONAL ENGINEER
AUTHOR
Timestudy Fundamentals for Foremen
Timestudy for Cost Control
How to Chart Timestudy Data

Rating studies, such as the one sponsored by S.A.M., are exceedingly important projects. The results should help us to solve one of the most vital problems in timestudy. The answer sought is a rate of working that can be adopted as a Normal measure of a "fair day's work."

The Normal is the base we use to set up standards for wage incentives. It determines the point where extra earnings begin. It is the rate of working expected in return for the base pay.

Standardizing the Normal is highly desirable for many reasons. Two should be mentioned here. Obviously, standardization would bring about consistency in work requirement. Standards and incentive premiums would be more uniformly fair. Secondly, standardization is becoming increasingly necessary because hourly rates for like work are getting to be more nearly identical.

Hourly rates are approaching uniformity by job class through wage surveys. Community wage rates are common knowledge. But we have not awakened to the necessity for surveys of the correlated Normals of work equivalents. That is a type of project our A.I.I.E. Chapters should be working on diligently.

Such surveys would present many difficulties. All of the commonly heard objections would be raised—"Our business is different," "ours is the Whosits plan," "we can't make any changes."

Are these objections sound reasons or are they excuses? How long can we continue with inconsistencies? What are the prospects in competition when we pay different prices for the same output?

We have different labor costs when we have like wage rates and different work standards. The differences in standards may result from different Normals in rating, relax factors and incentive plans.

Incentive Plan

Incentive plan differs for many reasons. One I want to mention. It is an accepted specification for incentive plans that is in error, in my opinion. The literature specifies that an incentive plan should be selected to suit the type of industry. But in contradiction, the experts in human relations tell us that incentives appeal to the best in human nature. Further, they tell us that human nature is the same the world over. If these are facts, then we are wrong in assuming that a type of industry has any bearing on the correctness of an incentive plan. Put the other way around, there seem to be good reasons why incentive plans should not be different.

If this is true, then the chief reason for differences in Normals for work standards would be washed out.

Relax Factors

The second difference is caused by inconsistency in relax factors. Here, relation is meant to include allowances for fatigue and personal. Such allowances vary between plants for good reasons and also by accident. Sometimes, the main difference is a factor stuck in to adjust for some phase of the incentive plan. This percentage cannot rightly be classified as a relax factor.

Now, if we exclude differences due to incentive plans, the relax factors themselves are not the same for like jobs in comparable plants. This is because the Normals are not the same. Whether the chicken or the egg came first, we do not know.

In this connection, there is another difficulty that we should be aware of. It appears to me that when we use a narrow range of relax factors to cover a wide range of work, we tend to shift our Normals to compensate. Maybe an example will emphasize the point. Suppose we use an allowance of 20% for fatigue. Assume the range of jobs covered is such that it would be more correct to apply 10% on the easiest and 30% on the hardest work in that range. Obviously, if fair standards are set, then the Normal has been shifted to compensate. A correct performance rating of 60 U/H has been called a 55 on the easiest work. A 60 Normal has been rated as 65 when the relax applied was 20% that should have been 30% in the example given.

This shifting of Normal is more real than imaginary. It has shown up in several training groups. What the right answer is remains to be proved. My suggestion is that we should have a standard for Normal and change the fatigue factors to suit the strenuousness of the work. As long as we mix rating with relax we must be aware of the fact that we expect the individual timestudy man will adopt different Normals throughout the range of work he studies.

Experience vs. Training

All of these differences show up when we put on a rating session in an S.A.M. Chapter. Some chapters have sent me summaries of their results. Usually, these include figures that reflect the amount of timestudy experience in the group. Those conducting and participating in the sessions seem to be impressed by the amount of experience.

Exerience in timestudy may not be any index whatever of skill in rating. So my question is, "How many weeks of training in rating did these men have?" The answer usually is, "Not very many." Of course, we all recognize that either experience or training in wrong methods may be worse than none at all. Lack of training is one of the big gaps that I think we are overlooking. Training needs to be more extensive than we realize. The meager information I have indicates a need for some 8,000 to 10,000 practice ratings. This rough measure is taken from a Learning Curve that summarizes the progress of about 100 trainees. Contrast the guesstimate of eight to ten thousand with the usual number of practice ratings and you see what I mean by lack of training. More particularly, ratings made in training are measured against some standards for accuracy. The error is known. Such practice ratings are not the same, therefore, as an equal number made as part of experience.

Aptitude

Then in training, another factor is pointed out. Some men can rate more accurately than others. Certain men can learn more easily than others. This becomes apparent when an individual's progress is plotted against a learning curve.

Obviously, the element involved is an aptitude. What that is, we don't know yet. How to test for it is even more vague. A number of people suspect that the aptitude is related to what we call rhythm. Some attempts have been made to check this hypothesis with the Seashore rhythm test. The check is too meager to show any conclusions either for or against. However, we must remember that some men can rate much better than others. In addition, we must search for the test that will select those who can learn to rate.

Personality

In conclusion, there is another phase of this subject that should be touched on. I refer to the personality of the timestudy man. He may have difficulties aplenty even if he has the requisite aptitude, training, and standards for Normal and relaxation factors. He may be unsatisfactory as a timestudy man because his approach is poor. If he causes a negative

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Plant Relayout --- Why and When?

...by W. Grant Ireson

Professor of Industrial Engineering,
Stanford University

Paper presented before the San Francisco Bay Area Chapter of the American Institute of Industrial Engineers, Inc., March 6, 1952

Plant layout is one of the major areas of work for industrial engineers even though comparatively few companies employ engineers specifically for this work. It is very logical that the industrial engineer should be chosen for this work since plant layout is actually a specialized application of methods engineering, which has been a part of industrial engineering since its very beginning.

Every factory employs plant layout in some way, even though you may not find any formal organization for handling the layout problems as they arise. If you were to ask many factory managers whether or not their plants needed plant layout engineers you would probably get the answer "No." If the plant employs men, machines, or materials; if it receives materials and supplies and ships finished product; if it has office functions to be performed, or if it provides a service to the public, the plant has need of technical layout knowledge. The layout problems are being solved some way, and usually by a piecemeal method. The objective usually is to provide for immediate needs with very little thought being given to future problems that undoubtedly will arise. The results are very likely to be something less than the best, and actually are likely to contribute to new problems in the near future.

One of the difficulties in this matter comes from the concept held by many that layout applies only to new plants. They think nothing remains to be done about the arrangement of the physical facilities after the plant is put into operation. If this were true, there would be very little need indeed for layout engineers. The number of new plants planned each year is small compared to the total number of plants in operation. This is the minor and easier problem to be solved. The great bulk of the plant layout work that is done is in regard to the rearrangement of existing facilities in existing buildings. For every new plant that is planned each year there are hundreds of relayouts. Each of these is made within an existing building and among existing layouts of other departments with all the resulting complications. The presence of certain machines, processes, materials, handling equipment, personnel facilities, receiving and shipping departments, and facilities for the production of products other than the ones under consideration all add to the complications of replanning a certain division or department. These limiting factors are such that it is much more difficult to develop an over-all, long-run objective and to make each relayout contribute to this objective than it is to plan an efficient and effective layout for a new plant.

Perhaps it is advisable at this point to define plant layout. Plant layout consists of those procedures, practices and concepts by which the physical facilities of the entire plant are arranged relative to each other. It has as its objective an efficient working unit in which the human element is utilized for productive work and as little as possible is spent in carrying on nonproductive functions. Actually, plant layout is as much concerned with the arrangement of offices, storage facilities, materials handling and management functions as it is with the arrangement of machines within the departments and the departments within the plant. It is necessary to understand the modern concept of a factory before this ultimate objective can be understood. The modern concept of a factory is that the factory is a unified production machine; the building is simply a shell for the machine to provide the proper protection from weather, prying eyes, and sticky fingers. The factory should be as nearly an automatic machine as the type of manufacture and the line of products will permit. We are all familiar with the massive transfer machines in the automotive industry in which such parts as the motor block castings are completely machined by a series of operations on one machine. Each set of operations is performed simultaneously as the parts progress from stage to stage. The operator sits at the control panel ready to stop the machine if any single set of tools fails to function properly.

The factory can be compared with this transfer machine. The difference lies in the fact that there are many parts and each producing unit is not physically tied to the others. When one stops, all need not stop. Management sits at the controls ready to slow down one process, change the tools of another, rearrange the physical layout, buy new machines, or add new employees to keep all the parts of the factory working at a desired rate and in as great harmony as possible. Thus, the objective of plant layout is to obtain an integrated unit.

This concept of the modern factory should influence our thinking regarding the layout of the plant. Especially it should influence our thinking in connection with each separate relayout. It should dictate that an over-all plan which anticipates the future, for a few years at least, should be prepared before individual relayout problems are started. Each relayout should contribute to the over-all plan. Furthermore, relayout should not be limited to the rearrangement of machines and equipment, but should be extended to all other facilities that affect the production rate and production costs.

I imagine that many of you are saying something like this: "That's all right for some factories, but our plant is different," or "We produce dozens of items, and each one requires special treatment or processing so that it is a separate facility from all the others." However, the basic ideas here presented can be applied to some extent to all plants. Mushroom growth, rapid changes in product designs, rapid expansion of sales, hit or miss addition of equipment and employment of untrained workers have contributed to inefficient practices. Temporary decisions have resulted in poor layout in a great many instances. The layouts could have been better with no greater expenditure and with savings in operating expenses if the separate problems had been approached as parts of one large problem rather than as so many independent problems.

The title of this paper presents two questions which have a single answer. Relayout of a plant or portions of a plant are undertaken for economy reasons almost exclusively. It is considered whenever it is believed that the resulting savings will more than repay the cost of making the relayout. Thus a trite but true answer to the questions of why and when is: Relayout whenever the needs justify the expenditures for relayout. We are, however, concerned with obtaining a more useful set of answers than this one.

There are numerous reasons why relayout of a part or all of a department, or of several divisions of a plant, should be investigated. These reasons may be classified in several ways, but the following will serve our purposes. These reasons may fall under the headings:

1. Inefficient or ineffective existing layout.
2. Changes in products.
3. Changes in volumes.

Under each of these headings there are definite signs that indicate when a study

should be made to determine the possible savings resulting from a relayout of specific area. Most of these signs are similar in nature to those which all of you know and use in your methods engineering work. In fact, in many instances the relayout of a section of a plant is indicated by a motion and time study made for other reasons. Also, the solution, after the problem is located, may be based more upon ordinary principles of motion economy than anything else.

Inefficient or ineffective existing layout is nearly always indicated by such things as:

Congestion in specific areas;

Overtaxed temporary storage areas;

Failure to meet production schedules or shipping schedules;

Complaints from foremen that additional space, machines or workmen are needed to meet production schedules;

Damaged materials in temporary storage areas;

Unexplained drop in production rate as some of above items occur;

Poor quality of product;

Excessive inventories of work-in-process;

Complaints from workmen about speed-up, heavy work, or the foremen;

Complaints about comfort conditions (heating, ventilation, etc.);

Poor housekeeping;

High accident rate;

High labor turnover;

Frequent reassignment of skilled workmen to less skilled jobs;

Frequent loss of material-in-process;

Increasing burden costs for such items as production control, cost control, or supervision.

These are just a few suggestions which can be used for a rapid check-up to see if a relayout study will be justified. A preliminary study of the possible changes, and the resulting savings, will then reveal whether a relayout should be made. The form of the study will be very similar to the preliminary study which you use in methods work.

The improvements in layout can be expected to bring about such effects as reduction in direct labor charges, reduced burden charges, improved production rate, better supervision, fewer complaints from foremen and workers, and reduced time in process.

Changes in products result from changes in design to simplify production processes, deletion of old products and addition of new ones, annual model changes, introduction of new and more economical equipment to replace obsolete equipment and material changes or substitutions. Of course, management is well aware of the existence of each of these conditions and should advise the plant engineers far enough in advance so that the relayout necessitated by these conditions can be studied thoroughly before the deadline for the change. This advance notice not only assures that a complete study may be made but that careful plans can be worked out for the plant changes so that there will be as little interruption of production as possible. Each move can be scheduled for the maintenance men or millwrights, and preparation of outlets for power, water, steam, gas or any other service can be installed in advance of the actual move.

Changes in volume result from increased or decreased demand for existing products. This may be brought about by new product designs, obsolescence of products, increased public acceptance, etc. Here again the changes can be anticipated to a certain extent from market surveys, sales reports, and product development reports. However, the accuracy of prediction of the former set of causes may not be duplicated in this set of causes. Change in total volume is usually upward, since the great majority of manufacturing concerns grow in size and output over the years. The natural result is to expand the physical facilities by building additional buildings, purchasing new equipment, and adding to the work force. The problem of relayout is important from this viewpoint for two reasons. Frequently the additional investment of capital funds can be prevented or reduced by a careful relayout of existing facilities so that maximum output is obtained with present equipment and buildings. The other reason is that possible future expansion, especially in terms of additional buildings, is not often considered in the original factory plan, and the addition of new buildings actually increases the cost of certain burden items such as material handling, provision of heat, light and power, and relayout of existing facilities to make use of the added floor space. The long-range objective of factory planning should take into consideration the probable future expansion. Present layouts should be prepared so that future expansion can be accomplished with minimum interruption of existing facilities and still retain low operating costs.

Practically all of the reasons I have mentioned why plant relayout should be undertaken have revolved around economy considerations. Cost or expense is the great watchword in every industrial concern and it is only natural that most relayout projects must be justified on the basis of dollar savings versus dollar expenditures for the changes. There are, however, other measures of the effectiveness of an existing layout. To mention a few, there are:

Ratio of direct labor hours per unit to indirect labor hours;

Number of handlings of a part or product;

Distance a product travels in the course of manufacture;

Elapsed time from issue of raw material to completion of part;

Number of and complexity of forms used in controlling the production.

Each of these tests may be applied to an existing arrangement and then to a proposed plan to determine whether or not an improvement has been made.

Unfortunately, as long as a company is making a comfortable profit and paying an attractive dividend on its stock there seems to be little incentive to look critically at its practices concerning manufacturing processes, materials handling, personnel facilities, utilization of facilities and constantly increasing burden expenses. When competition makes it difficult to sell the product in the necessary volume to obtain a satisfactory profit, then management becomes disturbed. It begins to examine its practices to find means of reducing costs and regaining its competitive advantage. The program of action usually takes the form of pressure on foremen, supervisors and engineers to reduce costs immediately. The urgency of the problem often precludes the possibility of a systematic and thorough study of the problems and results in halfway measures to correct undesirable conditions. My point is that, in most of these instances, the very causes, and I am thinking only of layout conditions, could have been located and corrected by a systematic program of layout improvement before the conditions reached a critical stage and profits became unsatisfactory.

It is now possible to give a more plausible answer to the question, "When?" There are three schemes for timing the relayout of a plant or portions of the plant. The first scheme may be termed the "periodic layout," which is the type generally practiced where the company changes models every year or so. The second scheme may be called "continuous" in that the relayout is going on continuously throughout the plant with some master plan or schedule determining what projects shall be studied and in what order. The third scheme is called "accidental" for lack of a better name. This scheme has no master plan or schedule and the relayout possibilities are studied when someone thinks that improvements in a certain section can be made that will satisfy some particular need.

The first two schemes naturaly are more desirable from the viewpoint of industrial engineers who like to work toward some objective rather than depend upon the uncertainties of accidental programs. I do not mean to belittle the third scheme as a source of ideas and brilliant solutions. The workmen and foremen at the work stations are far more familiar with the intricacies of the job and the sources of waste than the engineers. Under any of the schemes for

timing the relayout program, the persons closest to the actual work should be consulted in all sincerity to obtain their suggestions for solutions before a plan is made, and these men should be asked to criticize the final plans before they are adopted.

The advantages of the first two schemes are probably obvious. Under each plan those persons responsible for the planning of the factory facilities can obtain an over-all viewpoint on the problems and formulate a long-range policy. Each individual problem can be keyed into this long-range program so that each layout complements the others. Having a plant layout group (or for that matter only one person on a part-time basis in small companies) assures that layout problems are someone's responsibility. There will be some continuity of the work, regardless of how infrequently layout problems arise. This group of individuals can develop a high degree of skill in assembling the facts of the cases, sorting out the irrelevant material, analyzing the data, and preparing the plan. The general knowledge of how to attack the problems will increase. The actual cost of studying layout problems and finding solutions will decrease, just as the costs of making methods studies decrease as the methods engineers gain experience, knowledge of the company's processes and equipment, and skill in handling the study.

Up to this point I have mentioned nothing about the effect of types of industry on the problem of why and when for relayout. In spite of the many classifications of industry which have been used for organization study, only two classifications are necessary for plant layout problems. These are (1) Continuous and (2) Interruptable. The continuous industry is one which must be operated twenty-four hours a day and seven days a week as a result of the processes. The reason the plant must be operated continuously is that it cannot be shut down on short notice without suffering severe loss of materials-in-process, damage to equipment, and high costs of starting the process again. Naturally, this classification takes in such industries as open hearths and blast furnaces, rayon mills, sugar refineries, paper mills, and many other industries of similar nature.

The interruptable industry is one which can be shut down on short notice without incurring any loss through damage to equipment or work-in-process and only suffers the cost of lost production time. This is characterized by job shops of all kinds, woodworking, metal working, and most of the mass-production industries, such as automobile plants and home appliance plants.

It is also obvious that you may find examples of each kind of industry within one plant.

The difference between these two types of industry as regards relayout exists primarily in the timing of the layout. The continuous industry plants are customarily designed as balanced producing units. Continuous flow of materials through many stages is provided by balancing the productive capacity of each stage through the use of different numbers of units. It is clear that a relayout of one production unit in a continuous industry may easily necessitate the rearrangement of many other units in the line. Even obsolete equipment is sometimes used for many years because the cost reduction resulting from its removal and the installation of a new piece of equipment will not overbalance the high costs of all the related changes.

On the other hand, individual units can usually be removed and replaced, or placed in other positions, in interruptable industry plants without necessitating other changes. Therefore, frequent changes which result in cost savings can normally be justified more easily in interruptable plants. The result is that great care is taken in the design of a continuous type plant to be absolutely sure that the plan will work efficiently and that the very best equipment and procedures have been incorporated in the plan. The building is the last item to be designed. The plan must have the prospect of operating for many years at an efficient level without major changes or relayout. This does not mean that new equipment, new processes, or improvements in product specification shall be ignored. It simply means that such companies should set up a procedure for periodic examination of recent developments. Through an engineering economy study it should determine if any of the developments can be introduced into the plant at a saving in cost per unit produced.

Such care is not frequently taken in the design of interruptable plants. In fact, buildings have been built for the production of a specific product even before the number of machines required for the production volume had been calculated. This, perhaps, is not as bad as it sounds. If the building has been designed with certain characteristics which facilitate relayout and provide for flexibility in arrangement, it may actually be better than a building planned around a specific layout of the required equipment.

One of the principal ideas that should be included in a long-range plan should be provisions for easy and inexpensive relayout of equipment. The use of bus duct for electric power and lighting, grid system distribution of steam, compressed air and gas, high floor load capacity, and ease of securing machines to the floor

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without permanently damaging the surface are some of the factors which increase the flexibility of the building. Flexibility enables a company to change layouts as frequently as necessary for effective production and effective utilization of the available floor space. The easier it is to actually make a change in layout, the easier it is to justify the change through cost reduction.

IETNOU

(Continued from Page 13)

be incentives for more nonproduction workers including supervisors.

5. TOMORROW'S INDUSTRIAL ENGINEER: The drive for greater productivity with less production costs will force management to regard the industrial engineer as the professional member of top level management. The main function of tomorrow's industrial engineer at top management level will be that of coordination and integration of working teams with a common objective.

Yes, the wheels of tomorrow's industry will revolve around the industrial engineer's decision, as the lives and billions of dollars in property hovers over the decisions of today's railroad and airport "DISPATCHER." Not a train moves one inch over the main tracks of a railroad, nor does a plane take off or land without the "GREEN LIGHT" from the dispatcher.

Tomorrow's industrial engineer will be the dispatcher for industry. He will fix the purchase department schedule of items to be purchased. He will peg the raw material in process. He will set finished product inventory level. He will establish personnel policy. He will be the guardian of the budget. He will be the coordinator and adviser of these activities.

These are just a few of the tasks the future industrial engineer of tomorrow's industry will be doing as a key member of top management's industrial team. The opportunities are unlimited.

(The committee's next report is to include comments on the "LABAN SYSTEM" and its application to industrial engineering.)

PACE RATING

(Continued from Page 14)

attitude of mind, his ratings will be low. You may say, "What difference does that make if he rates correctly?" Certainly it makes no difference if we think only of arithmetic. But what about this thing we call attitude, industrial relations or human engineering? What about the selling, persuasion or acceptance that is necessary before the objective can be attained? In my opinion, we should do most or all of our "selling" during the timestudy process carried on to establish standard data. In this we should be able to bring about good performances and be obligated thereby to apply above Normal ratings. That comes back to the personality skills of the timestudy man. He should induce good performances by his approach. When he can fairly apply ratings above Normal, he has gained the confidence of those being studied. He has gained general acceptance of his timestudy work.

Superior sales ability must not be used to cover up poor standards. We have to solve the technical phases of ratings. We must push on until we find answers to the question, "What is a fair day's work?" Yet we must remember that technical formulas do not solve human problems. We can apply our findings only through the timestudy man. We cannot substitute a technical accuracy for a human engineering skill. Therefore, we must not expect to solve the important problems of timestudy by technical strap-hangers. The need for skill in man-to-man relations will continue to be the most important element in good timestudy work even when we have settled all the technical questions.

ALPHA MU

(Continued from Page 13)

Georgia Tech on February 28, 29, and March 1 of this year, Charles W. Brennan of Georgia Tech was elected national president replacing Dr. Lehoczky, the first president of the society. Bert H. Norem, head of the industrial engineering department at Syracuse University, was named vice-president. The three councilmen selected are Clifton A. Anderson of Penn State, Herb Manning of Virginia Polytech, and H. G. Theusen of Oklahoma A. & M. The able executive secretary and moving spirit, Jim French, was re-elected. Col. Frank F. Groseclose of Georgia Tech and Dr. Lehoczky are advisory members of the executive council. The convention also laid out a program for building up our alumni membership and forming alumni chapters and for strengthening and expanding the society.

The society publishes *The Cogwheel* three times a year. Al Thomas of Atlanta has recently retired as editor. The new editor is now being chosen by the executive council. In addition to news of the society, *The Cogwheel* contains articles of general interest to the profession.

With the founding and growth of Alpha Pi Mu, the profession of industrial engineering now has a student honor society with large and increasing membership to aid in strengthening the profession.

LOCAL CHAPTERS

(Continued from Page 7)

from the older members or to extend it to the junior members. Where student chapters are close by, opportunities exist for the guidance of student members.

If a community or industrial area has ten or more industrial engineers meeting A.I.I.E. eligibility requirements, it has the potential membership necessary to start a chapter. The amount of work required to accomplish and maintain the organization is surprisingly small—and richly rewarding in personal professional development.

Complete instructions on how a chapter may be organized is just a part of the service offered by the National Headquarters, through the Chapter Organization Committee. For more complete information or for instructions on how the benefits of a local chapter can be made available to you, write to National Headquarters or direct to M. A. Payne, Chapter Organization and Extension Committee, 1352 Croyden Road, Cleveland 24, Ohio.

Committee members: H. W. Spitzhoff, Robert Heller & Associates; D. R. Lamimon, U. S. Gage Corporation; R. E. Shafer, West Virginia University; M. A. Payne, Chairman, The Lubrizol Corporation.

COOPERATIVE RESEARCH

(Continued from Page 5)

that interesting as these results may be in themselves it is the general approach, the basic orientation, of this work which carries the broadest implications with respect to the future development of the field. It is an orientation which may offer a place of repose for arguments over the question of whether time study is or is not scientific. From his examination of the evidence the author takes an emphatic stand that time study is not scientific, and doubts that it is likely to be. But he also holds that the question is in reality of no great consequence:

". . . There is no evidence to show that any time study system in practice has been or is likely to be accepted or rejected on the basis of whether it is or is not a science. When a system is used to determine rates for incentive pay purposes the practical criterion, from the employee's viewpoint, is that he be able to earn somewhat more on the average than the man who holds a job which is pay-rated just below his, and that he may do this without exerting what he considers to be an undue amount of effort. If the time study man can set acceptable rates with a substantial degree of consistency it is no fundamental concern to the workman whether he does it by means of a crystal ball, shrewd guess, or electronic computer. It is true that the

employee finds it more difficult to contest a rate produced by what has been represented to him as a 'scientific' system; but this is no solution in the long run."

According to the author, the concept of a "scientific system" of time study has a use similar to that of the "ideal" thermodynamic Diesel cycle. It is useful to theoreticians, researchers, and designers but has nothing to do with the selection of an actual Diesel engine to perform a specific practical service. The selection of an actual engine from among several alternative choices is related to the function which it is to perform and upon considerations of first cost, operating cost, ease of maintenance, etc. Similarly, he says, the evaluation of a time study system for solving problems must be based entirely upon practical considerations. An entire section of the treatise is devoted to a discussion of the practical functions of time standards and the practical criteria which may be used in selecting techniques for performing those functions.

While practical criteria are emphasized for matters relating to the solution of practical problems, the role of the scientific investigator is also of great importance according to this analysis.

". . . The function of science is to provide the knowledge on which progress is based. Consequently, the pure scientist is concerned with criteria by which he judges the validity of knowledge and not with criteria which may be appropriate for judging the relative usefulness of solutions to practical problems . . . The post-mortem judgments of a research pathologist are likely to have a substantially higher degree of reliability than the expert opinions of a medical diagnostician. To most of us, however, there is little practical appeal in the fact that diagnoses by autopsy are more scientific, and so we reserve to the research pathologist the job of advancing knowledge so that the practicing diagnostician may improve the reliability of his decisions. This illustration suggests the fundamental relationship between the scientist and the practitioner upon which a sound profession may be built. It is the professional obligation of the scientific investigator to assure the validity of the conclusions which he advances. It is the professional duty of the practitioner to familiarize himself with scientific developments in his field and to utilize them to the best of his ability in the solution of practical problems."

The research studies reported in this work illustrate well the sort of scientific research which needs to be conducted in this field. This research required the use of analytical techniques which may not be thoroughly familiar to every practitioner. The results of the analyses, however, have rather far-reaching implications that may be quite readily appreciated. In a statistical analysis, for example, of the basic data from a number of synthetic time systems the author and R. W. McGuire have found some rather substantial discrepancies among the various systems. These differences appear to be of such magnitude that if any one of the systems should be accurate, the others could not be. Analyses of these differences also show that they are systematic in nature and cannot be accounted for simply by differences in the concept of a normal performance or by the inclusion of allowances.

In addition to the three appendices dealing with research studies, the reader also finds a thoughtful discussion concerning Dr. Gomberg's proposals for the use of control chart criteria in evaluating time study data. Both logical analysis and experimental evidence are offered to show that Dr. Gomberg's proposals should be regarded as hypothetical and that there may be good reasons why control chart criteria would actually be inappropriate for time study applications.

The impression may be gained that the findings may not readily lend themselves to application by the practicing Industrial Engineer. The researchers are fully aware of their obligation to their practicing colleagues that their findings must be integrated in such a manner that practical, applicable methodologies may evolve. These methodologies are expected to be increasingly more practical, economical, useful, and effective tools for the better solution of an increasingly more complicated society.

There is no aspiration that this group will ever supply the cure-all for the ills of the industrial world, however, it is looked forward to the evolution of an era of objectivity in Industrial Engineering. It is our belief that this can be achieved through searching for more 'absolute truths' through cooperative research.

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9. Korn, K. T., MANHOOD OF INDUSTRIAL ENGINEERING, Berk & Assocs., Cleveland, 1951

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